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AGRICULTURAL ENGINEERING

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Rural Industry—A Challenge for Agricultural Engineers *C. J. Hurd, F. E. Price*

Vertical Farm Diversification—Some Engineering Aspects *True D. Morse*

Construction and Management of Farm Ponds for Fish Culture *John R. Carreker*

Some Postwar Objectives for Agricultural Engineers *Leslie E. Hazen*

How Extension Work Can Promote Better Farm Housing *S. P. Lyle*

THE JOURNAL OF THE AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS

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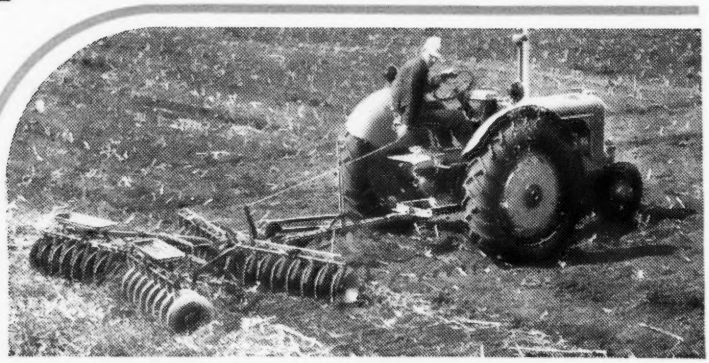

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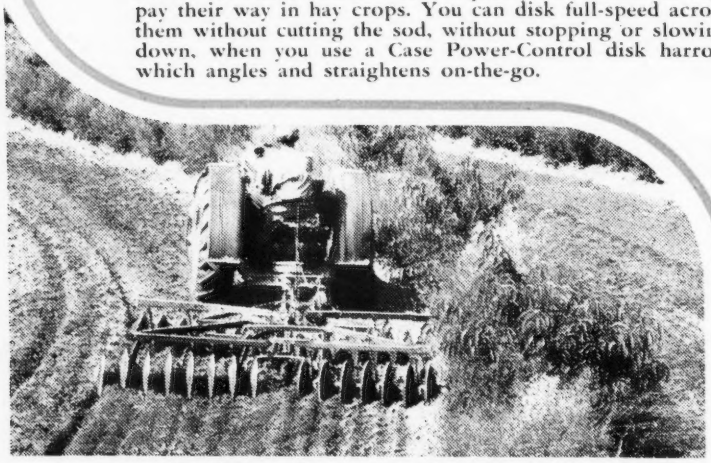

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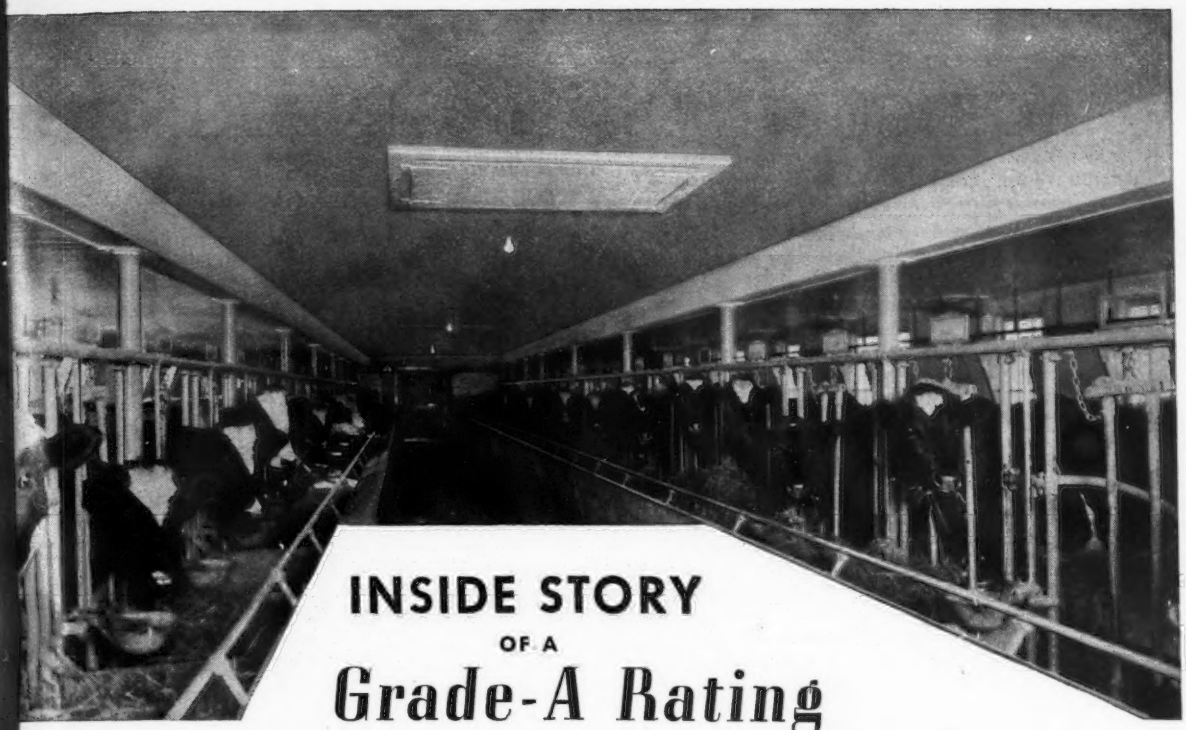

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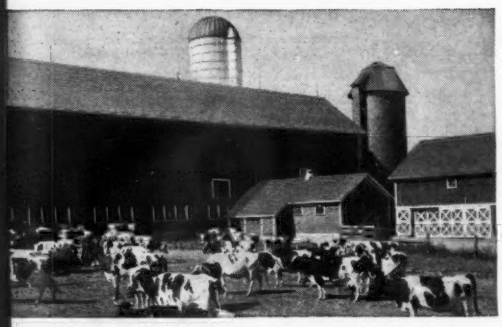

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EDITORIAL

Rural Industry

AFTER reading the papers and comment by Messrs. Hurd, Price and Morse published in this issue, we confess to some confusion on the subject of rural industry — what it is, what it should be, and what should be the policy of the agricultural engineering profession toward it. But we do have a feeling that there is need to verify the premises on which its more enthusiastic predictions are based.

One premise which seems implicit is a supposition of surplus labor in the farm family, or in the farm community. To be logical for rural industry, such labor must be somehow attached to the farm, at least seasonally. Otherwise it is merely part of the mobile national labor force, with neither responsibility nor advantage to agriculture, as such.

Another premise which seems more or less taken for granted is labor free from the high costs and wastes of labor organization. Recent history and continuing trends offer no great hop for such freedom. It would be more conservative to assume the regimentation and exploitation of labor at least to, and perhaps through, the farmyard gate.

Still another implication is that rural industry will continue to be favored by tax-free or lightly taxed forms of organization, or lack of organization. Whether such tax immunity will be, or should be, continued indefinitely is problematical. Certainly the 25 per cent of rural population cannot perpetuate it by weight of voting power.

After blowing out the chaff, the kernel which remains is sheer engineering efficiency. To look forward soundly, we shall have to do our thinking not in dollars at present, but in man-hours for the long run. We must add up the various short cuts, notably in the transportation of water and in backhaul to the farm, and then offset them against the economies of larger-scale operation, more complete technology, and supervision by specialists. The rural industry which remains will be on a sound basis.

Not a National Poorhouse

SELDOM is it our privilege to publish a short article so studded with provocation to comment as Leslie E. Hazen's letter to the members of his new A.S.A.E. Committee on Postwar Objectives. We urge its thoughtful reading as it appears elsewhere in this issue. Most timely is his homely definition of A.S.A.E. purpose as being to "beget welfare for farmers, abundant food and fiber for the populace, and friendly recognition for the membership."

Conspicuously absent is any implication of another concept often encountered, namely, that agriculture should also be a welfare department for sick segments of the national economy, a dumping ground for seemingly superfluous population. Indeed, Professor Hazen refers specifically to "another school of thought which places agriculture as the reserve bank from which to draw and retire industrial labor; the farm as not a profit-producing unit in terms of cash income, but a place to stay in safety against famine."

Likewise, when settlement of submarginal or subdivided farms is proposed as a panacea for the problems of released military and industrial personnel, it seems proper to emphasize his insistence on living and working conditions, for small farms as well as large, comparable to those enjoyed by middle-class urban people. He concludes: "We can't do this in subsistence farming where we seed by hand and till with a hoe. Usually the folks advocating small-scale agriculture are making these recommendations for the other fellow; they contemplate having no part in it themselves."

In similar vein is one of the five recommendations issued last December (and recently mailed to A.S.A.E. members), when the Society's fall meeting normally would have been held, by a small but active group of Soil and Water Division men headed by the Division chairman, Howard Matson. They recommended that the Society "go on record as favoring the development of drainage and irrigation works as a long-time program based on national needs for food production and land-use adjustment, rather than as postwar projects to use surplus labor and equipment or to develop lands for settlement. . . ."

Far be it from us, speaking from a background of farm birth and boyhood, to belittle farming as a way of life or its incidental and intangible compensations in the way of wholesale environment, independence and its comparative security. But we insist that these are no more to be accepted in lieu of adequate income and modern advantages, material and social, than are such other incidentals as proximity to a university, access to a good trout stream, or the climate of California. Still less are such incidentals any excuse for thrusting upon agriculture a job as a national relief agency.

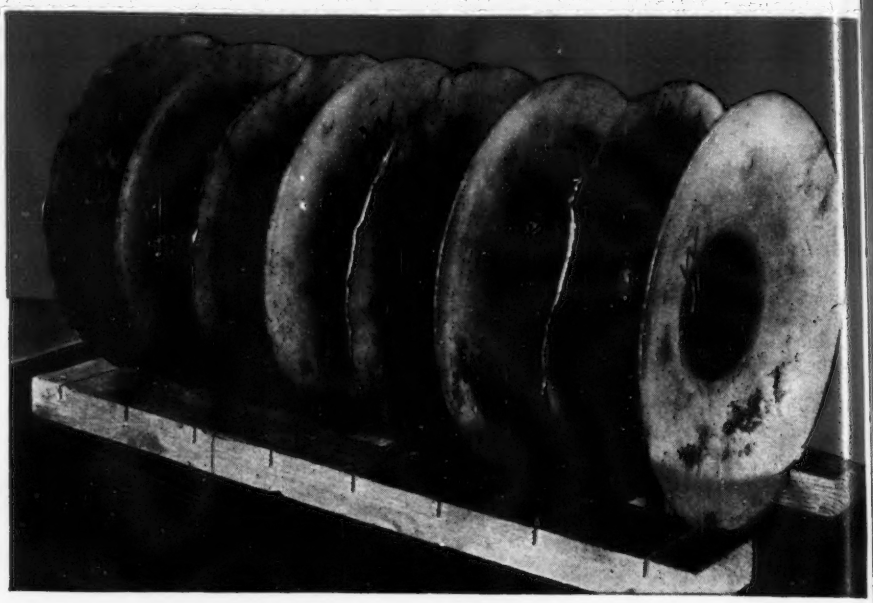
"Culture in Agriculture"

THIS phrase in item 23 of Professor Hazen's epistle and the Matson group's recommendation 5 on agricultural engineering curriculums, referred to in the preceding editorial, both remind us of a clipping brought to our cursory attention by an A.S.A.E. member. As we recall its substance it told how one of the colleges of Western Reserve University had reviewed the long-range results of educational policy, and had decided to "go back to education" by restoring a greater proportion of the so-called cultural courses as requirements.

Perhaps we should admit that, under response to popular pressure, our universities have become largely trade schools on a little higher level. Since the great mass of popular sentiment springs from persons who never enjoyed higher education, it is excusable that they have not progressed beyond the bread-and-butter concept of such education. Upon those who have partaken of higher education, and particularly those whose judgment has ripened through years of experience and observation, rests a responsibility to proclaim the vision of education as something for citizenship and leadership, for richness of life as well as for a richer living.

One of our postwar problems will be an academic generation of young people who are trained but not educated. They will be influential both by their youthful energy and by the respect they have earned as fighting men. It will be their right to have much to say about the rehabilitation of America and of the world. To do so wisely they should have some insight into the history of civilizations, the principles of economics, the ways of governments, the reactions of material and spiritual influences on men and nations.

Just how more of the humanities can be injected into curriculums already fully loaded, and with more fundamental science and engineering clamoring for inclusion, remains a question. We suggest an appraisal of subject matter to see what may successfully be left for postgraduate or other deferred study, formal or informal.



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AGRICULTURAL ENGINEERING

VOL. 26 FEBRUARY 1945 NO. 2

Rural Industry—A Challenge for Agricultural Engineers

By C. J. Hurd

MEMBER A.S.A.E.

WE ARE told much about the importance of rural industry to agriculture and to our national welfare. We Americans get enthusiastic over many things, and rural industry ranks near the top in our desire to keep the United States in front as the leading country of the world. Thoughtful people have studied the problem for years with the basic fact before them that our national welfare is dependent on the most effective utilization of our natural and human resources. Do we have most effective use of our resources with raw materials predominant in one region and concentration of industry in another? And within a region should there not be a diffusion of industry?

Those who believe concentration of industry is inevitable and that diffusion implies abandonment of large-scale production methods may consider rural industry a backward step in our national economy. Before either the proponents or opponents can gain their points, I believe it is necessary first to define what we are talking about. For example, what is a rural industry? I have searched the literature to obtain a definition but to no avail, and I have asked many engineers and business men. Usually the first answer is: "Why, it's a small plant located in a rural area." On question as to size they become vague. Most opinions, however, are that the size of the plant has no bearing on the matter, but that it should be limited to the processing of agricultural crops. This of course opens the door and lets in canneries, textile mills, cigarette factories, sawmills, dairy products plants, and a host of others. Then the question of location. Should we define rural industries as those confined only in unincorporated villages and strictly rural areas, or should industries in small towns be included? And so on *ad infinitum*.

For want of an accepted definition, in order to clarify this discussion, I would like to give my interpretation of a rural industry. It is an activity in which the predominant man power resides on the farm, and where modern technology is applied to fabricate, process, or otherwise transform products into a more finished state.

This definition may be far from perfect, but it will serve the purposes of my discussion. It avoids involvement in size, exact location, or the items that may be produced. As I see it, rural industries have three major reasons for existence:

1 To provide effective full or part-time employment of a certain number of rural people who otherwise might not be able to find creative and profitable employment unless they moved to a new location.

2 To aid in agricultural development by virtue of higher farm incomes in the area served through processing of crops.

3 To give economic opportunities for a diversity of employment in a given community and thus tend to keep rural areas more stable. Human talents and bents are very diverse; a great many of the fine people now in rural areas cannot be induced to stay there unless they can find jobs in keeping with their aptitudes.

Farm Population and Rural Industry. One of the most controversial questions that will face our country after the war is that of providing profitable employment for those who wish to make farming their principal occupation.

It is difficult to be specific on this problem from a national standpoint. We do know, however, that as farming becomes more and more mechanized, better crop strains developed, and soil fertility improved, fewer workers will be needed per unit of food output. A study of statistics on the gainful workers employed in agriculture and farm population as a whole reveals what, on the surface, may seem like conflicting facts. During the period of 1920-40, farm population decreased about 4.2 per cent; gainful workers in agriculture, however, decreased about 18 per cent. One plausible explanation is that, although fewer workers were actually needed, the combination of factors, such as older people remaining on farms, the high rural birth rate, and the desire of others for rural living, kept the total farm population roughly stabilized during this 20-year period.

The farm labor force has steadily declined in proportion to our total population. In 1870, about 180 people per 1000 population of the United States were gainfully employed in agriculture. By 1900 it had decreased to 125 per 1000 population. Each decade since has seen a material decline, and in 1940 approximately 80 people per 1000 population were termed the labor force in agriculture. Even during the war, with an ever-increasing food output, the curve continues downward, and at the close of 1942 about 77 per 1000 were gainfully engaged in agriculture (see accompanying chart).

The moment a farmer buys a tractor or electric motor to mechanize his farming operations he is "industrializing" in the same way as when a factory installs power units and production equipment to turn out manufactured items

When farm youth now in the armed services or in war plants begin to consider where their best opportunities lie in the postwar world, it would appear that agriculture will be at a new crossroads. Will we see these potential agricultural leaders trickling into cities or into new occupations not directly associated with agriculture? Agricultural engineers, I think, should give careful consideration to programs that will, in the long pull, contribute in making opportunities for creative and profitable employment in rural areas. Granted that many jobs that need to be done in agriculture are not done; granted that if done far more people are needed than now employed; granted that this is especially true in the southeastern area of small farms and soil conservation problems — still the evidence in this record of the past is overwhelming to the effect that great numbers of aggressive and fine rural youth *will as a matter of fact* leave rural areas unless far more diverse employment opportunities are provided there, and

This paper was presented at the annual meeting of the American Society of Agricultural Engineers at Milwaukee, Wis., June, 1944.

C. J. HURD is chief, agricultural engineering development division, Tennessee Valley Authority.

unless there is a far larger *sum total* of employment opportunities. As I see it, rural industry has the unique combination of providing industrial workers and farmers alike with opportunities for distributive employment, and it should go a long way in attaining an economic balance between farm population and agricultural income. Let us see how it works in practice.

Agricultural Processing Industries. In a five-county area in east Tennessee, fruit and vegetable growers depended almost entirely upon the fresh market for their outlet. In normal years it was problematical if the market would be sufficiently stable to provide a source of dependable income. With the technical assistance of the University of Tennessee and the Tennessee Valley Authority, the growers organized a cooperative in 1940 and set up a freezing plant in the town of Cleveland, Tenn. (population, 11,300), which was operated from 1940 through the 1942 season. In 1943 priorities were granted for a new plant which was located at Dayton (population, 1900) in an adjoining county. These combined operations by the Chickamauga Producers, Inc., at Cleveland and Dayton represented a total investment of approximately $85,000.

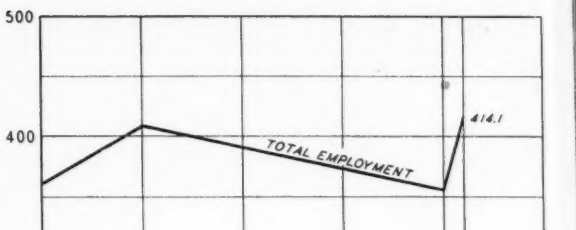
In the four years of operation of the Cleveland plant and one year at Dayton, the pack of frozen fruits and vegetables has gone from 250,000 lb a year to nearly 1,750,000 lb, and the balance sheet shows a net worth of $60,000, or 70 per cent of the original investment.

This is only part of the story. These processing plants have an annual payroll of approximately $30,000 that goes chiefly to the women and young people of the rural community. Over 450 growers are participating, with increased returns in 1942 and 1943 amounting to 70c to $1 a crate for strawberries and Youngberries and 90c a bushel for string beans.

The size of these two plants has been found insufficient to take care of the needs of the area, and both are being expanded. At Cleveland the operations will include a 700 locker plant to provide the members and urban residents with family food preservation facilities.

After the war these plants should be just as practical. For the first time in the history of this section the growers will be assured of a steady market for their produce. No longer need they see fruit and vegetables go to waste after the fresh market becomes glutted or prices go so low that farming operations are not economical.

This, I believe, illustrates how modern technology has gone to work to benefit agriculture and rural welfare in this particular area. Other changes will come about as the farmers and business men see opportunities for agricultural development. Already agricultural engineers have been called on for technical assistance on irrigation for quality and yield improvement.



This chart shows the employment of the labor force per 1000 population in the United States, 1900 to 1942. (The "Services Industries" curve includes military personnel.) These data are derived from "The Economic Almanac" (1943-44, pp.117-118) issued by the National Industrial Conference Board

Rural Industry on Farms. Rural industry, according to my definition, does not need to be a centralized or group activity. This definition is purposely adopted because of the great potentialities for on-the-farm rural industry. It is this broad scope of activities in which I believe lies a real challenge to agricultural engineers. True, it is not as dramatic as inducing a manufacturer to locate a branch plant in a rural area, or to organize a group of farmers to set up a processing plant. But if we are thinking of how to improve agriculture, let us go to the grass roots and help that farmer to become more efficient on his own farm. Isn't it just plain common sense that farm technology is a major step in the development of a more prosperous community?

Let me explain further what I mean by "on-the-farm" industries.

TABLE 1. NEED FOR MACHINERY, EQUIPMENT, AND TECHNICAL SERVICES IN TENNESSEE WATER-SHED COUNTIES IN VIRGINIA
Based on a Test-Demonstration Survey of 331 Farms Made in 1941 by the Virginia Agricultural Extension Service

Number of counties, 9 — Number of test-demonstration farms reporting, 331
Number of farms in area, 23,353 — Rural electrification in nine counties (1940), 24 per cent

	Status of 331 farms: Number of farms reporting equipment or needs	Per cent of all 331 farms	Potential for all farms*	Estimated expenditures for all farms in 9 counties to satisfy needs
1 *Irrigation and Drainage*				
(a) Area irrigated	22.6 acres		Data not available	
(b) Area drained	1254 "		" " "	
(c) Farms requesting technical assistance	93	28	6,400 farms need technical assistance	$ 640,000 ($100 per farm)
2 *Farm Buildings*				
(a) In need of repair	164	50	11,500 farms need technical assistance	575,000 ($ 50 per farm)
(b) In need of new buildings	176	52	12,000 farms need technical assistance	6,000,000 ($500 per farm)
3 *Home Conveniences*				
(a) With electricity	206	62	6,000 farms yet to be served, 50% saturation for area	600,000 (less line costs)
(b) With running water	178	54	1,800 add'l water systems, 40% saturation (elec. farms)	180,000 ($100 per farm)
(c) With bath and flush toilet	109	33	1,500 add'l bathtubs, lav., etc; 25% saturation (elec. farms)	75,000 ($ 50 per farm)
(d) With electric range	63	30	1,625 add'l electric ranges; 15% saturation (elec. farms)	162,500 ($100 per farm)
(e) With mechanical refrigerator	158	77	3,327 add'l refrigerators; 50% saturation (elec. farms)	498,750 ($150 per farm)
(f) With washing machine	163	80	5,000 add'l washing machines; 60% saturation (elec. farms)	250,000 ($ 50 per farm)
(g) With radio	189	92	8,700 add'l radios; 80% saturation for area	435,000 ($ 50 per farm)
4 *Farm Machinery*				
(a) Need for repair	77	23.2	5,350 farms needing repair services	107,000 ($ 20 per farm)
(b) Need for replacement	82	24.8	5,800 potential purchasers	580,000 ($100 per farm)
(c) Need for new machinery	162	49	11,500 potential purchasers	1,150,000 ($100 per farm)
			Total	$11,253,250
			Average per farm, $482	

*Calculated by taking 1940 census data to determine present status and assuming the situation should be as noted. Also, assuming needs comparable to test demonstration farms unless otherwise noted.

I consider that the moment a farmer buys a ¼-hp motor and mechanizes hand-operated tasks he is industrializing in the same manner as when a large factory installs efficient sources of power and modern production equipment. Similarly, the addition of water pumps, milk coolers, power-driven machinery, and other facilities is putting that farmer in the position to make the most of modern technology.

This may seem like "old stuff" to the agricultural engineering profession. True, that is what we have been preaching for years, but have we succeeded? Can we truthfully say we are far enough along on this job to take a vacation? I do not believe so. A careful appraisal of our agricultural engineering jobs will show that there is yet much to be done. Chas. E. Seitz and his staff of agricultural engineers at the Virginia Polytechnic Institute made such an appraisal in a nine-county area in southwest Virginia. Table 1 shows the outcome. According to the farmers' own estimates, a total of $11,000,000 in equipment alone is needed, and the equivalent of nearly 30,000 engineering problems on the farm which should receive attention by private or cooperative organizations and by public agricultural agencies. Admittedly it is a spot survey, but I believe a conservative one.

An analysis of the acceptance of farm technology on a statewide basis is likewise illuminating. In Tennessee a study of a selected group of major crops adaptable to processing revealed that the estimated annual value of sweet potatoes, hay (all classes), poultry products, vegetables, small fruits, and legume and small grain for seed purposes, amounts to in excess of $65,000,000 (Table 2). Annual losses and out-of-state purchases by these farmers, due to lack of local supply of these products, amount to $22,500,000. Through the application of farm technology to storage, processing, electrical applications, irrigation, and farm machinery, these expenditures could be reduced an estimated 50 per cent or would result in a gain in value to the farmers of the state of $10,000,000 annually (on the basis of 75 per cent rural electrification). If all agricultural products were analyzed, this figure would of course be much greater.

The sorry part is that the acceptance of these farm technological developments is extremely low. According to the data obtained, less than one per cent of the farmers who have the electrical facilities have installed sweet potato curing units, barn hay driers, poultry water warmers, or irrigation systems. Educational effort has been put on electric brooding, resulting in 14.7 per cent saturation of this equipment and 10.5 per cent poultry house lighting on the basis of the present spread of rural electrification. A total of 62 per cent of the farms growing grain or legumes have thresher or combine service; the remainder, I assume, utilize the grain and legumes as forage.

Perhaps other states can produce a better record. I cite these data as an illustration of the magnitude of farm technology problems that confront agricultural engineers. To me the solution of these farm technology problems will enhance the individual farmer's income and pave the way for other rural industries. Let me illustrate by using another example for the Southeast.

In North Carolina a tremendous influx of soldiers and war workers increased the population in excess of a half million people in approximately one year. The problem of grade A milk supply immediately became acute. One processor had over 4500 farmers delivering milk to his plants, but only a few hundred gallons a day actually went into the retail trade as bottled milk. The simple reason of course was that these small producers did not have the facilities for meeting the state milk ordinance for retail milk. Almost over night, D. S. Weaver, head of agricultural engineering department at North Carolina State College, worked out a design for a 4-cow milking parlor with alternate plans for an 8-cow unit, with suitable milk cooling mechanical equipment, water heater, etc., for these small dairies. The processor decided that, in order to make it possible for a large number of farmers to install these facilities, he would work out a financing plan. He offered, under a contractual arrangement, to supply the building and equipment for any of the dairymen on his route, with repayments coming out of the increased price for the grade A milk. This margin, amounting to about $1 per hundred pounds, actually figures out that on the basis of 200-lb milk production a day the entire investment will be retired in one year. Mr. Weaver reports that approximately 225 farmers already have installed these facilities. Although designed for small dairies, many farmers are using these parlors for herds up to 16 cows. Thus an expanded rural industry is born in North Carolina. Yes, it was a war baby in its inception, but the North Carolina people say it is a permanent one. Incidentally, farmers from forty-five other states have written Mr. Weaver for construction plans.

TABLE 2. STATUS AND POTENTIAL BENEFIT TO AGRICULTURE IN TENNESSEE BY USE OF A SELECTED NUMBER OF TECHNOLOGICAL DEVELOPMENTS

Commodity	Production, 1940	Estimated value, 1940	Est. value of annual losses due to lack of proper process or equipment	Process or equipment to improve situation	Estimated no. farms that could use process or equipment assuming following extent of rural electrification			Resulting increased annual earnings with following extent of rural electrification			Est. no. farms now using process or equipment	Percentage of acceptance (25% elect.)
					25%	50%	75%	25%	50%	75%		
Sweet potatoes*	4,176,000 bu.	$ 3,674,000	$1,102,460	Proper storage houses with electric heating and control equip.	7,430	14,860	22,290	$ 213,575	$ 427,150	$ 640,725	29	.4
Hay (all classes)†	1,974,000 tons	$22,306,200	$5,576,000	Barn Hay Drier (Electric drive)	15,000	30,000	45,000	1,170,960	2,174,640	3,178,320	30	.2
Poultry. eggs‡	58,333,000 doz.	$10,092,000	$1,093,740	Lights in laying house. Electric water warmers	47,250	94,500	141,750	246,090	492,180	738,270	5000 lights 500 water warmers	10.5 1.0
Chickens	11,790,000	5,659,000	78,000‡‡	Electric brooders	47,250	94,500	141,750	17,550	35,100	52,650	7000	14.7
Vegetables and small fruits**	37,718 acres (total)	$12,805,886 (veg.) 4,858,151 (fruit)	$8,832,000	Irrigation (commercial crops using all types of power)	24,700	24,700	24,700	883,000	883,000	883,000	20	.08
Legumes and small grain (for seed)††	26,083,000 lbs.	$ 6,015,962	$1,280,000 (veg. only) $3,540,000 (Out of state purchases)	Elec. Hotbed	60,500	121,000	181,500	320,000	640,000	960,000	100	.16
				Furrow Seeder	30,000	30,000	30,000	3,540,000	3,540,000	3,540,000	60	.2
				Trailer Thresher	40,000	40,000	40,000				1,700	4.2
				Combine	40,000	40,000	40,000				23,340	58.0
Total		$65,410,999	$22,502,200					$6,391,175	$8,192,070	$9,992,965		

Basis for calculations:

*Sweet potatoes: Reduction of losses from 30 to 10 per cent and 10c increased value per bushel when sold

†Hay: Estimated 20 per cent loss of hay due to improved field curing

‡Poultry: Estimated 20 per cent increased egg production during winter months, brooding mortality decreased 10 per cent (no allowance for loss of labor)

**Vegetables and small fruits: 50 per cent increased production by irrigation and 10 per cent increased value in using electric hotbeds (better quality, earlier season, etc.)

††Furrow seeder combine; trailer thresher: Value of seed imported into state which could be locally produced (no value given for soil erosion reduction, pasture benefits, etc.)

‡‡There are many other tangible and intangible losses that are rather difficult to evaluate, such as labor-saving advantage of using electric brooding over other methods, and increased incentive for brooding own chicks when electric brooders can be used; also, where mortality is greater by 10 per cent with other methods of brooding, losses in chicks will also mean losses in feed consumed by chicks lost.

Agricultural engineers have real opportunities in these farm and rural community technological fields. Are we going to meet the challenge and accomplish the objectives, or are we going to be accused of being "too little and too late"?

A Basic Front to National Security and Stability. Engineers

pride themselves on being able to apply their technical skills in harnessing and utilizing energy. Agricultural engineers are particularly concerned with conservation and utilization of energy on farms and in rural community centers.

Sixty years ago about 30 per cent of the energy in the United States came from exhaustible sources; today we are dependent upon the same exhaustible source of supply for 85 per cent of our energy. It is vital to our national security and stability that we conserve as far as practicable the exhaustible supplies of energy which nature through the ages has stored up for our judicious use. By the same token, therefore, the challenge to agricultural engineers is to utilize to the maximum the energy that comes from the soil.

To appreciate the magnitude of energy values from agricultural crops, let us examine the power equivalents in a given area. In Tennessee, agricultural crops (less timber) produced in 1939 the equivalent of 35 billion kilowatt-hours (Table 3). The TVA power system in 1943 produced about 10 billion kilowatt-hours, or only about one-third the energy equivalent of agricultural crops of the farms of Tennessee. A 55-acre farm in Tennessee growing corn, tobacco, soybeans, alfalfa, fruits, vegetables, and about 18 acres in pasture, produces energy each year equivalent to nearly 200,000 kilowatt-hours.

The crops produced on our soil are made up of approximately 95 per cent of inexhaustible supplies of carbon, hydrogen, oxygen, and nitrogen. The other 5 per cent is from soil minerals. Although the minerals are relatively minor in amount, they are exhaustible and are dynamic factors in making use of the inexhaustible elements. To use only one example, a pound of phosphate makes it possible to "fix" 5 lb of nitrogen from the air into the soil. At the same time the growing plants also draw carbon from the air and hydrogen and oxygen from water to produce, through photosynthesis, sugars, starches, cellulose, and proteins.

How does rural industry fit into this pattern of conservation and utilization of our exhaustible elements? We should remember that the farmer will be in a much better position to conserve those elements if he has the opportunity to put into productive use the energy of the crops that he grows. Products that spoil for want of a stable market, or losses due to improper farm or community processing or storage, destroy to a great extent the valuable exhaustible elements that went into the making of those crops. The challenge is to capture the potential energy of the soil and to utilize it in the most efficient manner. It is a challenge worthy of our most sincere engineering efforts.

AG ENGINEERS NEED MORE TIME TO SPEND WITH FARMERS AND THEIR ENGINEERING PROBLEMS

Opportunities to Implement Rural Industries. It is easy to glorify the many opportunities to assist farmers in their engineering problems. We can all visualize the improvements that can be made, how much more efficient we can make their operations, yet we often fall far short of our expectations when we add up the results at the end of the year. Isn't one reason that we do not have sufficient time or man power to "sit on the back porch" with the farmer and think through with him the engineering problems that he is up against? Whenever you trace through most outstanding agricultural engineering achievements, you will find that someone or a group of people have spent a lot of concentrated work on the particular development. The mailing of a bulletin, the holding of a demonstration, or the visit of a saleman is surely not the end point. One prominent agricultural engineer in industry recently told me that he would be a poor salesman for his company, because whenever he visited a prospective purchaser he had the desire to discuss with that farmer how he might reorganize his farming operations according to good practices as the first step, rather than to purchase his product. I am not a salesman, but I believe that man had the right perspective. True, he might not make an immediate sale, but I wager he will make a friend — and my guess is that if his product fits the farm he will come out on top.

I consider the agricultural engineer the most important channel through which an expanded farm technology program may be developed. Please note that I said "channel" and not "group". This applies to any phase of our rather broad sphere of operations, whether it is teaching, research, field, or commercial work. It is my observation that agricultural engineers who attempt single handedly to conduct their programs oftentimes have rather meager results. This again sounds like old stuff to this group. How many of us, however, follow this fundamental principle of getting all the help we can?

TABLE 3. ENERGY VALUES OF CROPS AND PASTURES (1939, Tennessee)*

Crop	1939 production, lb thousands	Calories millions	Total energy expressed in British thermal units millions	Horse-power-hours millions	Kilowatt-hours millions
Corn	3,698,690	5,859,782	23,251,615	9,141.3	6,797 4
Sorghum	190,189	220,437	874,694	343.9	225.7
Small grains	403,080	590,439	2,342,861	921.1	684.9
Hay†	5,787,728	9,021,938	35,799,049	14,074.2	10,465 5
Potatoes	72,232	26,509	105,188	41.4	30.8
Sweet potatoes	170,703	95,594	379,317	149.1	110.9
Cotton	218,063	393,386	1,560,956	613.7	456.3
Cottonseed	400,000	907,600	3,601,357	1,415.9	1,052.8
Other field crops	117,072	179,244	711,241	279.6	207.9
Vegetables (sale)	195,509	19,727	78,259	30.8	23.1
Vegetables (home use)	1,173,057	118,027	468,332	184.1	137.1
Fruits and nuts	204.867	49,788	197,560	778.7	576.3
Crops (total)	12,631,190	17,482,471	69,370,429	27,973.8	20,798.7
Pastures	7,816,788	12,155,310	48,232,270	18,962.3	14,100.2
Crops and pastures (total)	20,447,978	29,637,781	117,602,699	46,936.1	34,898.9

*It has been estimated that the annual growth of trees 6 in in diameter and over in the Tennessee Valley (an area approximately the size of the state of Tennessee) is the equivalent of 37.4 billions kilowatt-hours.

†Includes, in addition to other hay crops, small grains cut for hay, annual legumes, and hay crops harvested for seed or nuts.

(AUTHOR'S NOTE: Acknowledgment is made to C. F. Clayton, executive secretary, TVA-Land Grant College and USDA Correlating Committee, for preparation of Table 3 and assembling data on conversion factors to analyze energy of agricultural crops.)

The development of rural industries, whether on farms or at some central point, is a prime example of the need for close cooperation by agricultural engineers with other engineering institutions and professions, with business, and with specialists in agricultural production or processing. R. H. Driftmier, head of the agricultural engineering department at the University of Georgia, reports over 437 canning plants, 34 dehydrating plants, and 10 freezer locker plants, all of rural community size, which are serving the food preservation needs of 70,000 Georgia farm families. In 1943, over 14 million cans of food were processed for home use and many tons of meat, fruits, and vegetables were either frozen or dehydrated. All of this has come about during the last 10 years. Credit for this outstanding development of rural industries is due to the people in the area and their local agencies who worked hard to obtain these facilities and who are responsible for their success. Technical assistance to the people was rendered by a number of agencies, including the Georgia vocational agriculture department, agricultural engineering department, extension service, agricultural experiment station, Georgia Power Co., TVA on certain phases, and a number of commercial concerns. No one group mentioned could have done all the work as efficiently and on time like this team.

In Virginia, the agricultural engineering department of Virginia Polytechnic Institute is the spark plug for agricultural engineering developments, but the motto of the department is "Let's work together." Private and public agencies find that department a common meeting place to work out state programs involving the application of engineering in agriculture. That is one reason for the national record this year of over 100 barn hay driers being installed in that state.

I cite the foregoing examples for a purpose. In the postwar period we are going to find farmers all over the country wanting to become more efficient in their farming operations, to do more about soil conservation, to improve their buildings, and to make the farm a more attractive place for their sons and daughters. Also, from all indications, private industry and business are going to set up improved facilities for serving the needs of farmers.

Such accelerated activities are going to require increased expenditures on the part of the farmer. They will also tend to reduce in some instances the man power needed to perform many farm operations. Theoretically, these two factors will have to be kept in balance or on the credit side, otherwise the advent of farm technology will not improve our agricultural economy. Agricultural engineers in industry and public service alike must constantly check their respective programs to put the farmer in the most favorable economic condition.

To do this I believe the agricultural engineering profession should take stock of the methods and programs for extending technical assistance to farmers. On this may well hinge the successful development of both on-the-farm and community or commercial agricultural industrial development.

I doubt if a formula can be developed from a national viewpoint to determine specific amounts of funds that should be set aside for agricultural engineering research or field work. It does appear logical, however, that farmers should have fairly ready access to latest information on new developments, field demonstrations, and technical assistance on items that cannot be handled by group discussion or by literature. I believe that the goal toward which to work is a minimum of one agricultural engineer or farm engineering technologist in each county where there are 2000 or more farms.

These engineers should be qualified to handle the farm and community technology problems of the agriculture of the county. True, they will need to call on industry, business interests, and other subject-matter specialists for assistance. They will also uncover new problems that should be turned over to research agencies for solution. But it is that end point — of actually getting technology to work on farms on a widespread scale—which will require technical assistance in much greater amount than has heretofore existed.

I believe the challenge to agricultural engineers can be very simply stated. Can we apply our technical skills and cooperate fully with others in a progressive effort to assist farm people in the maximum development of our basic industry — agriculture? Rural industry and farm technology go hand in hand.

Discussion by F. E. Price

MEMBER A.S.A.E.

THIS discussion of Mr. Hurd's paper is presented from the standpoint of the challenge and opportunity for agricultural engineers, but I wish to call attention to the proposition that other agricultural specialists will be needed in the full development of any rural industry program of any consequence. I particularly call attention to the importance of a very careful analysis and development of a program of marketing before any extensive development of rural industries is placed on an operating basis by agricultural engineers and other operating technicians.

Agricultural engineers are making valuable contributions to the development of agriculture and rural industries in the Pacific Northwest but much is yet to be done. This area has many problems which are similar to other areas of the United States in the production of small grain, potatoes, hay, poultry and dairy cattle but it is particularly an area of specialty crops. We are fortunate in having a group of farmers who are continually looking for new methods, techniques and equipment that will advance their efficiency in production, harvesting, storage or processing. Frequently visitors conclude that our farmers are now operating with a very high degree of mechanization and efficiency. Some might conclude that there is little left to be done in improving efficiency on the better farms. Our better farmers know that this is not correct. Agricultural engineers surely cannot ask for greater opportunities to improve efficiency in production, storage and processing in the field of agriculture than those now before us. Anyone doubting this should ask our distinguished agricultural engineering colleague, Dr. J. B. Davidson, if he does not think that further work to improve the efficiency of corn production and harvesting might be a questionable project in view of the extensive research that has already been done along this line. I wish every agricultural engineer could hear Dr. Davidson express his belief in the great opportunities for further development in Iowa's greatest industry and how even a very slight advancement can contribute much to the wealth of that state.

This is the type of thinking we all must follow in studying the farming enterprises of our respective areas and there may be several areas within a state requiring special consideration.

The development of rural industries will advance best in those rural areas in which the people and the technicians who serve them are continually alert to opportunities for increasing the over-all efficiency. I would like to cite a few examples of developments by agricultural engineers, their associates, and the people on the land that have greatly aided rural industries.

F. E. PRICE is research agricultural engineer, Oregon State College.

Vegetable and fruit processing is an important rural industry in western Oregon. Green beans is an important crop in this program. They were originally grown for canning without irrigation. This industry apparently started in a somewhat favorable period in so far as rainfall was concerned but soon it was concluded that a more uniformly high quality of raw material was necessary to maintain a steady market demand. This appears to me to be somewhat similar to the hemp situation in the Middle West, starting major developments in favorable weather years for dew retting which were followed by years in which dew retting producd inferior quality, thus pointing to water retting under controlled conditions, to turn out a uniform quality of fiber to the spinners.

And so irrigation in Oregon, where irrigation had seldom been practiced, appeared to be the only solution to the green bean quality requirement. The best land was adjacent to the river and subject to winter overflow and shifting soil. This uneven topography could not be irrigated by furrow or flood methods and leveling was impractical due to flood conditions on most farms. Irrigations by sprinkling appeared to be worth a try. Experienced growers believed sprinkling in the warm summer sun would injure the tender blossoms and thereby reduce the total yield. Furthermore, the available equipment was quite unsatisfactory.

Portable sprinkling equipment was developed, tests proved that irrigation by sprinkling did not injure the blossoms, the quality of the green beans was uniformly high and the harvest season was lengthened. Yields increased from 2 to 6 tons per acre at once, although with improved fertility practices made possible by irrigation, yields of 10 tons per acre are now common. Continuation of this food processing industry was assured.

Irrigation also increased the yield and quality of other cannery vegetable crops such as beets, carrots, and sweet corn. Some fruit had been canned in this area but the operating pattern began to change. Instead of long shutdowns between crops, the engineering of the production of raw materials of uniformly high quality to the capacity of processing plant and the market has developed a year-round food processing industry with a minimum of overhead per unit of output with a high degree of uniformity of labor demand in relation to the seasonal supply. During the summer months approximately 1000 persons are now employed in one of the leading plants in this rural food processing industry. Also 16 different fruits and vegetables are processed in year-round operation in this particular plant.

AGRICULTURAL ENGINEERS PLAYED AN IMPORTANT PART IN SAVING AND DEVELOPING GREEN BEAN INDUSTRY

Agricultural engineers played an important part in saving and further developing this important industry. Other agricultural technologists also made valuable contributions to other phases of this development, but the development of a practical program of irrigation in this new area and convincingly demonstrating its value is worthy of special mention because it was the turning point in saving this industry.

The farm value of the crops grown for this food processing industry is higher per acre than many other crops but this is still small as compared to their value to the community.

A few examples will suffice to illustrate this point. Last year the canners paid the growers an average of $75 a ton for pears. The 40 cases of pears which can be packed from this original ton wholesaled at $264 at the plant. Canners last year paid an average of $21 per ton for beets which had a wholesale value of $145 when canned, while a ton of sweet corn advanced from $23 to $102 by canning. We have both producers' cooperative-owned plants and private-owned plants in this area.

This same type of irrigation equipment was later used in tests on dairy farms in our coast region. By supplementing the heavy annual rainfall by sprinkler irrigation during the dry months of July and August, the annual milk production and income of these farms was increased greatly in excess of the increased costs. The cheese factories which take the entire milk production of this area and are cooperatively owned by the producers, had ample facilities and markets to process and seal this very substantial increase in milk production which was brought about by agricultural engineering research followed by farm demonstrations.

The reduction in man-hours required to process fiber flax by mechanization of this formerly European industry is an outstanding example of an agricultural engineering contribution to the advance-

ment of a rural industry. This development is the result of research by W. M. Hurst, senior agricultural engineer, USDA Bureau of Plant Industry, Soils and Agricultural Engineering, and his staff and includes an automatic comb type deseeder, an inexpensive tow cleaner and a combine harvester which pulls the flax, deseeds the straw by the combing method, ties the straight and untangled straw in bundles ready to be hauled to the retting tank and threshes and cleans the seed.

The war has hastened the expansion of this industry to its present four million dollar annual level, but the improved efficiency which has resulted from this research has contributed much to the output for the war and the postwar security of this industry which employs 30 to 60 persons in each of 13 plants throughout the entire year.

The potato and onion dehydration industries in Idaho are largely a wartime development. Three potato dehydration units and one potato flour mill were in operation before we entered World War II. Now there are 10 major plants which process between 8,000 and 10,000 carloads annually. Three starch plants were started prior to the war and they process about 1,600 carloads of raw potatoes annually. The industrial alcohol plant which was developed after extensive agricultural engineering research, has been expanded to an annual capacity of 300,000 gal requiring 15,000 tons of cull potatoes. The postwar period will probably bring major problems to these rural industries.

The specialty crops of the Pacific Northwest present many unsolved problems of harvesting, processing and, to some extent, storage. We have always considered our sheep production a major enterprise in Oregon. We are surprised, however, to find the value of our turkey production nearly equalling our income from sheep. This new turkey industry of nearly $7,000,000 is presenting new problems. Utilization of more of the waste products of our apple, pear and other fruit and vegetable plants present real challenges. We must continue our work in the harvesting and distilling of mint until we reduce harvesting losses and labor requirements. Our nut growers want a machine to pick up filbert nuts from the ground. Research is under way and a machine will be ready for the 1944 harvest. The frozen food pack will increase after the war in the Pacific Northwest and agricultural engineers will have an opportunity to aid in this program.

These are but a few of the examples of the many opportunities for the agricultural engineer to improve agricultural production, storage and processing, and rural industries.

If properly done, agriculture will want more of this kind of service. What more could we ask?

Another "Livestock Compound"

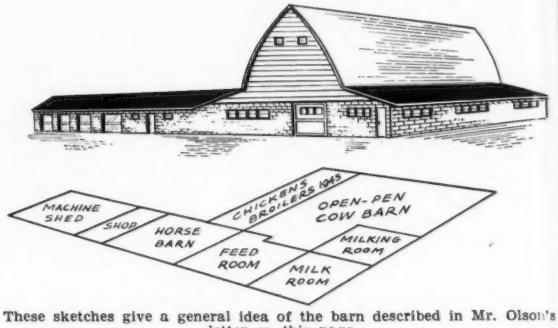
TO THE EDITOR:

I WAS interested in the article, entitled "A Firesafe, Labor-Saving Livestock Compound", by E. L. Hansen, in AGRICULTURAL ENGINEERING for November, 1944. It so happened that at the time I had such a barn, at least in principle, under construction.

In our barn, we were interested principally in economical and efficient operation, as well as in fireproof or fire-resistant construction. We wanted also to eliminate critical materials as much as possible, and we were striving for a practical unit.

The main part of this barn (shown in the accompanying sketches) is two-story, 30x82 ft, with Gothic arch laminated rafters. Along each side of the main section is a 17-ft wide lean-to. A 24x80-ft wing extends to one side, and is a continuation of the front of the barn. This unit houses the shop, machinery, and horses. The main barn and lean-to houses poultry, dairy cattle, milking and milk room, and feed room. Originally a tile hog house was also connected with the unit, but it was later eliminated. In the feed room is the feed grinder and sheller and elevator with overhead bins. The mow floor loading was designed to handle chopped hay. The first floor walls to the plate are of 8-in concrete block. The overhead bins and mow floor are supported by reinforced concrete beams, columns and footings. Above the masonry wall between the shop and the horse barn we built a fire stop with plaster board to the gable roof. A plaster board fire stop also closes off the lean-to from the hay mow.

Originally there were 14 buildings on this farm which were reduced to four. Outside of the residence, the only buildings remaining are a shed in good condition and a concrete stave corncrib



These sketches give a general idea of the barn described in Mr. Olson's letter on this page

and granary. We plan to raise the elevator in the corncrib so as to get enough height to spout the grain from the crib, when needed, to the bins in the barn. The grain in the barn can be spouted to the sheller or grinder and then elevated to the overhead bins and handled from there to the livestock in carts and trucks.

I agree with Mr. Hansen in most of the points presented in his article. However, our plan varies from his in that we have a two-story barn for the main section. We think this fits into our plans best as most of the harvesting operations are mechanical and the chopped hay handles easily when being fed. We are also very close to our feeding operations with a bulky feed, and gravity will help a great deal in getting the feed to the livestock.

By using the open-pen type of barn most of the manure handling will be mechanical, that is, with a power loader. By using deep bedding we feel that most of the liquid manure will be absorbed without the use of a pit, or having to consider special equipment to handle this part of the manure that is usually lost.

The dairy cows will be fed in the open-pen barn and milked in the milking room with a combine milker. Most of the handling of the milk will be eliminated as it will go via pipe line from cow to milk can. A small steam boiler in the milk house will provide heat and live steam to sterilize the dairy equipment.

We did not eliminate windows as Mr. Hansen thought possible in his article, for the reason that most city milk ordinances provide that there has to be so much window area per cow. We did, however, consider using some glass block but found the cost too high at the present time.

From our preliminary estimates it appears that we will be able to make some worth-while savings in labor. Also, we believe the design to be flexible enough to take advantage of many of the new ideas being developed, including shifts in domestic consumption trends. We know we have a compact unit where most of the farm chores can be done under one roof.

Because of a shortage in labor we have not been able to get all of the details completed and we will have to wait for some equipment. The barn superstructure has been completed, but will not be ready otherwise for operation until some time in February (1945).

Some of your readers may have objections to some of the ideas I have expressed relative to the open-pen barn, but I have had enough experience with them to know that they work. In fact, I couldn't get help from some of the colleges that are investigating this type of barn, so had to develop walk-through arrangements and combination feed bunks and stanchions to meet our particular needs.

CARL R. OLSON

Owner, Olson Management Service

Ag Engineer's Job in Soil Erosion Control Defined

AS defined by R. B. Hickok, research project supervisor in charge of SCS agricultural hydrologic studies at the Purdue University Agricultural Experiment Station, in soil erosion control the agricultural engineer is "concerned with the successful handling of concentrated quantities of water moving off from farm land. It is his function to devise, install and test practical structures to retard the flow of such water, increase absorption into the soil, and dispose of the remainder without damage to the land by erosion. He is also concerned with the development of new or specially adapted farming equipment and tillage practices which will be conducive to water and soil conservation."

Vertical Farm Diversification

By True D. Morse

THE economic problems of the farms of this nation are far from solved. For the moment there prevails a sort of "fool's paradise", a respite caused by the war. The struggle with surplus farm products is not over. Unless a sound program is put into effect promptly there may be again the sad spectacle of a great nation attempting to get rich by destroying wealth, crops and pigs. There will be another attempt to prosper by dividing less.

There will be no permanent or satisfactory political solution. Such must come from within agriculture with the aggressive application of the talent of all those who serve farmers. Until the solution comes from engineering and scientific sources, the economic ills of agriculture will continue to receive political panaceas to the detriment of all.

The immensity of the problem is shown by the productive capacity that during the most destructive of all wars has swamped the markets with eggs and hogs and has maintained great surpluses of such products as cotton and wool.

American farms are businesses. As such they can be most profitable only when operated at optimum capacity. In this they are no different than industry which does not prosper when shut down or running only a few days each week.

Any agricultural program, therefore, that is most effective must provide for a large, not restricted, volume of production.

A basic characteristic of farming is that it is a raw material producing industry. As such it is subject to low pay and violent price fluctuations. Those who are closest to primary production usually have small incomes as compared with industry, commerce and finance.

As long as farmers continue to be primarily producers of raw materials, most of them will remain near the economic level of peasantry. That has been the general pattern of earning and living for most farmers down through the ages. It will continue until a more constructive program becomes effective.

Two developments hold great promise of a sound and lasting solution. They complement each other to a considerable extent.

1 *Farm chemurgy* is pointing the way to the use of agricultural products in industry. An ever-increasing volume of farm products is flowing into industrial items. Of most encouragement is the promise that products of farms now considered waste, or in some cases pests, will be converted into value through the cooperation of chemistry and industry.

2 *Vertical farm diversification* is the second development appearing on the horizon that may well eventually overshadow the first. It is this hope for a more prosperous agriculture that will be further discussed.

For generations authorities have urged upon farmers the need for the balance of operation and security that comes from diversifying. The method advocated is the production of a variety of products. Instead of primarily growing just one crop such as wheat, the farmer has been told to spread labor and equipment use and obtain income from more than one source. That is diversification on a horizontal plane. To put it into practice too often requires reduction of the most profitable crops or enterprises. The net effect may be a major loss in profits.

Vertical farm diversification operates in another direction. After producing a raw product, diversification comes by processing, packaging, or special marketing, or the activity may be in connection with items and services required for production. The farmer takes over some of the functions of industry and trade. Much of the activities now visualized will take the form of rural industry. It diversifies the work of farmers. It diversifies their income by bringing in money that was formerly paid to other businesses. The results are far-reaching and will greatly improve the economic status of the farmer of tomorrow.

There are common forms of vertical farm diversification that have been in use for years. The cotton planter takes one step in vertical diversification when he gins his own cotton and a second step when he stores the bales of lint and the seed. The farmer who separates cream from skim milk and sells the cream and feeds the skim milk has processed his raw product — vertical diversification. When on his farm, or through his cooperative creamery, he produces butter or cheese he further processes his product, takes it closer to the user, and secures more of the consumer's dollar. The grower of corn and other feeds who uses livestock to convert these into cattle, hogs, wool or eggs is engaged in another form of processing that is as old as farming.

Agriculture is ready for more advanced steps in processing. Engineering and the sciences already have knowledge waiting only application to farm and rural use. Stationary and portable processing and packaging machines will make it practical for individual farms and rural communities to take additional steps forward in preparing farm crops, livestock, and other products for consumer and industrial use. They will squeeze out tons of water now being transported at high costs. They will separate oil from meal so the meal can remain on the farm for feed and the oil can be used to mix needed farm paint and the rest can be shipped direct to industries. Cellulose will be separated out of the waste or low value crops so it can go direct to papermakers and other industrial users. The lignin and minerals will go back into the soil to sustain fertility instead of becoming a public problem through mass disposal and stream pollution when concentrated as it is now at great factories.

The extension of electricity to farms has paved the way for all machines and equipment that are electrically operated. Now it is practical to plan toward all types of developments that are available to urban industry.

Functions. Here are some of the specific fields within which some of these machines will work; they will do these things on the farm and in rural areas:

1 *Extraction.* Oil and protein from such seed as cotton, soybean, castor bean, sunflower, flax, peanut, tung, perilla. There are at present two or three types of oil extraction plants designed for small communities. The one which is being perfected at Iowa State College is designed to permit a plant to be installed in each township where soybeans are grown as a major crop. Soybean producers are for the most part the major customers for the soybean oil meal. If they take all of the meal, they will buy back about 80 per cent of the tonnage of beans delivered. Soybean oil is now successfully used 100 per cent in excellent paint, and certainly paint is needed on farms.

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TRUE D. MORSE is president, Doane Agricultural Service, Inc.

The cotton farmer takes one step in vertical farm diversification when he gins his own cotton, and a second step when he stores the bales of lint and the seed

2 *Digestion.* Cellulose from plant stalks such as castor bean stalks, all kinds of grain straw, cotton, corn, soybean stalks. This is the first step in papermaking. Cellulose takes air, sunshine and water to the factory and leaves the vegetable matter and minerals at the community or farm plant. Community digestion plants can make a vast tonnage of annual cellulose available for the paper industry of this country. It is the largest untapped source of paper material.

3 *Compression.* (a) Low compression—stalks, straw; (b) greater and medium density—cotton, straw; (c) very high density—wood waste, stalks, and straw; (d) board from straw (The USDA Northern Regional Research Laboratory has already gone far in revealing the future possibilities). Economical compression of low value products will materially expand the area of their usefulness.

4 *Dehydration.* Alfalfa, potatoes, fruit residues, green grain, hybrid corn crops, cotton, milk direct from the cow, vegetable residues. The most promising effort in this field relates to direct separation of milk and fat and immediate dehydration of skimmed milk on the farm. This will permit medium-sized dairy farmers to sell parcel post direct to consumers.

5 *Fabrication and Separation.* (a) Cotton, flax, wool, mohair, coarse bast fibers, floss; (b) spin and weave into needed farm products as sacks, tarpaulins and other coarse goods. Natural fibers face tremendous competition with artificial in the postwar period. Probably no field will be more competitive than this.

7 *Distillation.* Essential oils — alcohol from grain and starch units.

6 *Refrigeration.* Community units, individual farm and home crops.

8 *Concentration.* Stalks, straw, cobs, waste to be used for industrial purposes.

9 *Feed Vitamin and Mineral Mixing.* New processes are now in sight which may entirely change present methods.

10 *Grinding.* Hulls, straw, cobs for plastic fillers.

11 *Construction.* The unit fabrication and construction of equipment and various types of farm buildings made at central plants and moved, ready for use, from manufacturing point to the farm. Also stoves, boxes, handles, furniture.

12 *Measurements.* Machines and equipment for weighing, testing, and measuring. All manufacturing demands a full complement of testing equipment. Agriculture has lacked this in the past.

Some specifications for most of the machines and equipment needed apparently will be these:

1 Cost below $25,000. The most widely used units must not greatly exceed $5,000 in cost.

2 The size must be small.

3 Units must be complete so one installation permits practical production of marketable products.

4 The machines must be simple to operate so semiskilled and non-skilled workers, not scientists, can run them.

5 Some items should be designed for first-step processing only — not final refining processing.

6 Some machines should put products into consumer packages ready for wholesale or retail sale.

These are obviously economic rather than engineering specifications. They indicate some of the limitations within which designing and construction engineers will need to work.

There appears three methods or bases of operation as we now visualize them.

1 *Kitchshops* in the home can be used for home processing. We conceive them to be a room or small building within which the housewife, the daughters, and domestic help will process food, both for home use and/or for sale. There will be much new equipment that will fit into such kitchshops. Grinding equipment can be used for breakfast foods, flour, and meal. Pressure cookers for cooking and canning will probably be in every kitchshop with the most effective equipment for canning many types of products. In some cases miniature canning factories will make possible volume production of home specialties, fruit, poultry, other meats, and vegetables.

Kitchshops will make possible income for farm girls which is now so seriously needed. Much of the urge to leave the farm for more money can be removed. There the farm girl can create and prepare both staples and specialties. With efficient equipment she can package many items ready for sale.

2 *Farmfac* has been used to designate the farm factory where vertical farm diversification is extensively employed on a farm. Farms are now equipped with much storage. There needs to be added, in many cases, only the factory buildings through which products will flow for processing. In ideal situations these operations will fit into those seasons of the year when labor is most available. It will help provide more regular employment. It will increase income.

Farm factories will accomplish on the farm what about 1,750,000 farmers each year leave their farms to do when they seek outside employment. In 1939 there were about 29 per cent of the farmers of the United States who worked part time off their farms for pay or income. They averaged 137 days out of the year. The average for 1929 was 100. This is an average increase of 37 days per year for each operator. Over 15 per cent of all farm operators work off their farms 100 days or more per year.

When farm processing becomes general, many will not have to leave their farms for extra work. If they do not have their own farm factory they may find employment in that of a neighbor.

The possibilities are unlimited. The primary need is for effective equipment. Witness what happens to milk in its travel from the farm to the city home. It's cooled, it's heated, it's cooled again, it's modified, standardized, loaded, transported, unloaded, packaged, loaded and unloaded until handling and numerous treatment costs add greatly to its ultimate price, hence decreasing its consumption.

POSSIBILITY FOR REVOLUTIONIZING THE DAIRY INDUSTRY

Apparently the day will come when the warm milk from the cow will go to a separator, then to a drier, after which it will be packaged and shipped by parcel post to the city customer who will purchase a month's supply at one time. The pure fat will go in another container, and with both products the housewife will always have at hand skim milk, 20 per cent cream, or any other proportion desired. This short cutting of laws, labor unions, and multiple processing and handling bids fair to revolutionize the dairy business.

3 *Rural Industry* will be given new and much needed impetus. Community processing will be greatly expanded to handle those jobs too complicated or too costly in equipment for individual farms. Cooperatives will be the type of organization that will own and operate many of these plants. They will be merely the expansion of the successful cooperative efforts that have resulted in threshing machine rings, creameries, cheese factories, mills, elevators, and other such rural enterprises for handling and processing farm products.

Agriculture waits only for practical machines with which to decentralize much of the industry built about farm products. This development will be a boon to the rural non-farm population that is definitely dependent upon and related to agriculture. This is about one-fourth of the nation's total population. Community processing will add further opportunities for part-time employment for farmers.

Attempts to analyze the competitive position of farm and rural plants with large centralized industry show many advantages to the farmer. Big industry has obtained many of these advantages by placing small factories in rural towns. It appears that further decentralization will take place in order to get less costly and more satisfactory labor.

Conservative estimates of cost of material, labor and overhead, and write-up to cover profits, show as much as one-third advantage for rural and farm enterprises. This is especially true considering the fact that farmers frequently produce at no profit in order to get pay for labor. They keep right on producing corn at 15 cents, or cotton at 5 cents, and they can be expected to do the same with their processing activities.

The first reaction of many in established city industries is that their businesses will suffer. There will be adjustments to make along the way but the ultimate result will be increased prosperity for city business.

Any sound developments that increase the prosperity of the farmers and of rural communities means more trade and industry for the cities. The farm and city interests will both be served.

The increased buying power will flow to the cities. Urban factories must make the needed processing plants. Final refining, packaging, and merchandising will, in many cases, be left to large industrial plants and city business. *(Continued on page 66)*

Construction and Management of Farm Ponds

By John R. Carreker
MEMBER A.S.A.E.

INTEREST in farm ponds has increased greatly in recent years. Many factors have contributed to this interest, chief of which no doubt is the work of the Alabama Agricultural Experiment Station on fish culture. The Agricultural Adjustment Agency payments in some states for the construction of farm ponds as a soil conservation practice has also stimulated interest, as has the help given farmers by Soil Conservation Service technicians who have included ponds in farm plans.

A small pond is a valuable asset to a farm. Its benefits include fish for food, recreation, water supply for livestock, for irrigation and for fire fighting, and a natural habitat for wildlife. Proper construction procedures make later management easier and these various uses more profitable.

Seven ponds were constructed on the Southern Piedmont Conservation Experiment Station of the U. S. Soil Conservation Service during the past two years, and this paper will discuss some of the general principles of pond construction and management and the practical information gained from these seven ponds.

The first consideration in pond construction is its location. The terrain should be such that a dam of sufficient height can be built to impound a good reservoir of water at minimum cost. A water surface area of somewhat less than an acre can make an adequate pond for a farm family. Generally ponds larger than a few acres cost too much for the uses discussed in this paper. A narrow depression between two opposite slopes with a wide flat area upslope generally makes the best site. There are many such sites in the Southeast, especially in the Piedmont. Sometimes gullies offer good sites.

Dams are constructed with power and machinery ranging from mules and drag pans to track-laying tractors and scrapers. Almost any farmer can determine his best method. In the case of the seven dams of our station excellent results were obtained with a track-laying tractor and a bulldozer.

To prevent seepage a core wall should extend down under each dam to impervious material free of roots and other organic matter. The three dams where this was not done, all have considerable seepage. The other four, which have core walls, have little or no seepage. The material for this core should be the best cementable clay loam available. Most humus-free A and B horizon material of the soils of the Southeast, except the extreme sandy and gravelly soils, is suitable for this purpose.

At many sites, especially in the Piedmont, this same material will be used for the entire dam construction. Where this is done, no core is needed above the natural ground line under the dam. Where uncementable soil, such as very sandy, gravelly, or unweathered material, is used in the body of the dam, the core of cementable material should be carried to the top of the dam. The dam should be built in thin layers and compacted as much as possible in the building process.

The slope to give the faces of the dam has been the subject of much recent discussion. Most published recommendations are for at least 2 to 1 and 3 to 1 slopes on downstream and upstream faces, respectively. A recent survey of small dams in South Carolina by the author and others failed to find a single dam that had been built to these specifications. Evidently farmers believe they are excessive. In building the seven dams at the Southern Piedmont Conservation Experiment Station the soil was allowed to roll to its natural angle of response. Some dams were then sloped by hand to a 2 to 1 slope, while others were left at this natural angle of approximately 1½ to 1 on either or both upstream and downstream faces. Wave action created a 6-in to 1-ft shelf at the water line, but no further damage was detected. The bulldozer blade made a top width of 10 ft. Two dams built on extremely soft sites settled about a foot over muck not supported by the bottom core wall. This was an actual settling and was not due to instability of slope on the face. The center section did not settle and a top width of over 6 ft still remains. These experiences have caused the author to conclude that the original top width of the dam is more important to the farmer than the slopes of the dam faces. A minimum width of 8 ft for farm pond dams is suggested. If the dams are to be used for roadways, additional width should be provided.

Ponds being constructed should be provided with drain pipes. A small iron pipe of a 4 to 6-in diameter is satisfactory. Fig. 1 shows a 3-in galvanized pipe in place in the deepest part of a ½-acre pond to provide for complete drainage, with no pockets where fish might be stranded when the pond is drained. A larger pipe would be better because it requires considerable time to drain a pond this size with a 3-in pipe.

An upright pipe screwed into a 90-deg elbow on the upper end of this pipe controls the water-surface elevation in this pond. Fig. 2 shows the pond filling after the dam and spillway were completed and this pipe was in place. In this particular pond the pipe takes all normal flow of water plus a good portion of flood flow as the top of the pipe is 6 in below the spillway level. Flood water runs in the spillway only a few times during the year, making the control of the spillway easily possible with perennial vegetation. No collars of any kind were used on any pipes installed and there is no sign of seepage along these pipes.

Inadequate spillways have probably more often been the cause of pond failure than has poor dam construction. Some ponds are built without any spillway, or with only a small culvert through

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Fig. 1 (Left) This trench for a core under a dam was dug by hand. The core is being formed with good clay from the hillside. The pipe to use for draining the pond is already in place • Fig. 2 (Right) The pond is beginning to fill in this picture. The dam has been completed and the pipe plugged by screwing the upright section in place. The edge of the pond at the left was deepened by using the earth in the dam

Fig. 3 (Left) a broad spillway is required to handle flood water satisfactorily. The drain pipe in this picture is being tested • Fig. 4 (Right) A long shallow end of this pond was diked off to reduce the area of shallow water. Pond water will be 3 ft deep where the road is held

the top of the dam. Sufficient spillway capacity is the best insurance a pond can have against flood flows. A rule of thumb being used at present for the size of the spillway is 1 ft of width for each acre of drainage area up to 8 acres and ½ ft of width additional for each acre above 8 up to 50 acres. Thus where a 20-acre watershed drains through a pond, a spillway 14 ft wide would be used. With a freeboard of at least 2 ft, this should be adequate. Fig. 3 shows a good spillway. These specifications are based on the assumption that flood water will not be diverted from the pond.

A much more desirable pond will be had if the shallow-water areas are eliminated in the construction process. The material for the dam can be obtained from the sides of the pond to provide for a depth of at least 18 inches at the edges in the lower part of the pond. Where the distance is too great to excavate entirely to the upper end of the pond, or where the dam is completed before all the edges are deepened, the remainder of the pond shore line can be diked off at a reduced cost. Figs. 4 and 5 illustrate how this was done in the case of one pond. The temporary pond above the dike is catching sediment while a sericea lespedeza meadow outlet is being established above the pond. Fig. 6 shows a pond edge that was deepened by cutting and filling.

This work may increase the cost of a pond, but future results should more than pay for it. Water weeds in deep water are controlled by fertilization. By deepening the shallow areas, other weeds are thus confined to the edges where they can be easily removed from the pond. Bass can then feed all over the pond, preventing excessive numbers of small fish. Mosquito breeding places are eliminated. Good fishing is possible all around the pond instead of at selected spots.

Where pond water is used for irrigating gardens or small truck-crop areas, an arrangement should be made at the time of construction to permit taking warm water from near the surface in the early spring and near the bottom in midsummer for stimulation of plant growth with water of the proper temperature.

Livestock should not be permitted to trample in ponds used for fish production, since muddy water prevents the production of fish food. Watering troughs below the dams and a fence around the pond eliminate this problem.

There are six main points in connection with the management of ponds for fish production, namely, proper stocking, adequate food supply, flood control, weed control, erosion control on watershed, and removal of mature fish. A proper balance in the number of fish and the food available produces more fish of usable size. A pond stocked with bream (a species that feed on plankton and aquatic insects) and bass (a species that feed largely on the bream) is a desirable combination for maximum production. An original stocking of 1,500 bream and 100 bass per acre for fertilized ponds gives best results.

The fertility level of most pond sites is relatively low. The addition of fertilizer elements of N, P, K and sometimes lime to the water increases the growth of plankton in the water. Aquatic insects that feed on this plankton are thus greatly increased, thereby providing more food for the bream. Approximately ten applications of 100 lb of 6-8-4 plus 10 lb nitrate of soda per surface acre of pond, put on at about monthly intervals through the spring and summer months are recommended by the Alabama Agricultural Experiment Station. Surface application from the bank on small ponds and from a boat on larger ponds is adequate.

In the course of construction, provision should be made for diverting all possible flood water around the pond. Flood water through a pond carries the fertilizer out, makes the pond muddy, and carries fish out of the pond spillway, thereby upsetting the stocking combination.

Water weeds should be removed periodically. They become very objectionable if not controlled. They use up plant food, provide mosquito breeding sites, and afford too much protection to small fish from the larger fish, as well as interfere with actual fishing.

Erosion should be controlled on con- *(Continued on page 66)*

Fig. 5 (Left) Appearance of the same pond site as shown in Fig. 4 after pond had filled • Fig. 6 (Right) This farmer surveys a job well done in deepening the edge of his pond. The completed dam is seen in the distance. In later years good fishing will be possible all along this bank

Postwar Objectives for Agricultural Engineers

In accepting an invitation from R. H. Driftmier, president of the American Society of Agricultural Engineers, to become chairman of a new committtee of the Society — Committee on Postwar Objectives — Leslie E. Hazen wrote his fellow committee members to find out just what they thought the term "postwar objectives" implied as a committee activity, also to set out some of his own thoughts on the subject. In his letter he makes an interesting approach to setting the sights for his committee, as he sees postwar needs; and it is a realistic and not an idealistic approach. We think it worth passing along to agricultural engineers generally, whose comments and suggestions on postwar objectives of the agricultural engineering profession, we are sure, will be most welcome to Professor Hazen's Committee.— EDITOR

AS TO effects of the war many think we are on the one position from which no matter whether we go forward, backward, right, or left, the direction is south — that we are in the middle of the woods and any direction leads out, choice being limited to route and destination! Originally we espoused the idea of an engineered agriculture to beget welfare for farmers, abundant food and fiber for the populace, and friendly recognition for the membership; I take we are not now departing from this initial intention, and any statements or codes our committee prepares are in furtherance of these fundamental purposes.

Will this war initiate sweeping improvements in farm devices which would not have occurred under the less stressful influence of continued peace? I know people who think so. As I see it we will merely swap old enemies for new and try to wring profits out of an impoverished market; the folks who have waited three years for electric service or a new mower have less lifetime to use and enjoy such gadgets accompanied with a declining desire to buy. Our backlog of savings must be largely absorbed by advanced prices, and the inevitable taxes — and the time itself is gone!

Our shortage due to war is not in goods alone; we are very lacking in sobriety, candor, religious conviction, courtesy, and tolerance. I've watched these virtues, which made my country community such a delightful place in which to live, pass away with the soil fertility, painted dwellings, native grass, and forest cover. You may be palled by the local color in the paragraphs to follow, but I'll justify my use of it because it is all around me and I find the hues both fascinating and significant. War pressure created our Dust Bowl. The aftermath of war sent our "Okies" to California.

For over a quarter century (it doesn't seem that long) I've roved this state like a wild Indian seeking to determine what farm folks really need in engineering service and education. These forays are promptly followed by modifications in subject matter and methods of presentation to meet these *needs* as I deem them to be. Notice that I confine my efforts to the needs rather than bothering about what my students want or think they want in the way of whims and fancies. This policy is not conducive to large enrollments in elective courses, but it has usually assured my classes being composed of members most likely to carry my teachings into effect. It is one thing to create a desire, but something more pertinent to establish the skills or habits on which its satisfaction depends. Take the mere matter of orderliness; the student will affectionately acquiesce in a fervid lecture on the care and arrangement of tools and parts, and flagrantly violate every principle thereunto appertaining the instant he gets hands on the laboratory equipment. Probably he has a desire to be orderly at the close of the lecture, but the dissertation itself is mere entertainment; his real education commences when the teacher exacts close adherence to orderly procedure.

It might be noted in passing that orderliness is *not* a feature of farmsteads in this state, and neatness is so rare that the person who practices it is a social ace in any farming community. I do not know which is the more futile, to extol bathing to the fellow content to remain dirty, or discuss plumbing with the tenant who must move from one primitive shack to another ere the year is out.

The story is told of a certain book agent hailing an Oklahoma hillbilly with the hope of making a sale. "This book", said the agent, "has over ten pages on cotton, fifteen on corn, thirty on tobacco, and twenty full color plates on fruits and flowers." The hillbilly shook his head dejectedly. "It also," the agent persisted, "has instruction for terracing, fertilizing, dairying, feeding, marketing, and treating sick animals." This also failed to elicit active interest. "And that's not all, here are prints and instructions how to make your own stanchions, hay hoist, harrow, lime spreader, and grain elevator." The hillbilly heaved a sigh, "No use, mister, I don't want the book; I ain't farmin' now half as good as I know, nohow." Anyone contemplating the increase in Oklahoma production, per acre and total, under the stimulus of good prices can glean more than a passing smile from that yarn.

There is such a wide gap between our precepts and practice. In almost any farmhouse hereabouts can be found voluminous literature on everything from vitamins to plasma, with cows licking dirt and chewing bones because of phosphate and lime deficiency in the adjacent pasture. Excellent articles on humus conservation and the benefit of vegetative cover lay unnoticed on the table while the tenant or owner sets roaring prairie fires to get rid of such cover.

As one approach to the job of setting up objectives for this year it seems to me we should blast the oft-repeated adage that this is a new country! I look over the dilapidated farm buildings, gully-scarred slopes, brushweed-covered grassland, huge roadside canyons, and depleted timber, with no sense of newness — we have passed the stage where conservation is sufficient and reached the point where reclamation is required if the increasing pressure of growing population is to be met. No, this central west bears all the marks of age and misuse, and as yet little evidence of constructive practices replacing destructive. Many of our tenants are like exhausted swimmers, not quite able to muster the extra strength and endurance to save themselves, and the landlord's lifeboat is a leaky dorry without sail or rudder.

What is the future of mechanized agriculture? There is the group who thinks the farm is destined to become a commercial unit based entirely on the cost of production and margin of profit; the individual holdings will grow larger, the total per cent of population engaged become smaller until perhaps some ten per cent of our population furnishes all food and fiber for the remaining ninety per cent. With modern machinery this is readily attainable. But we have another school of thought which places agriculture as the reserve bank from which to draw and retire industrial labor; the farm is not a profit-producing unit in terms of cash income, but a place to stay in safety against famine. Probably the true solution is somewhere between these extremes.

But I, for one, am firmly committed to the reduction of manual toil — I want fingertip control to replace main might and awkwardness in every phase of rural living. If I am to live on a small plot of ground with one cow, sow, and hen, I do not care to tote the hay and silage with a fork, shuck the corn by hand, and spread stable manure from a wheelbarrow. I'm earnestly determined to keep my hands soft and supple enough for the piano and violin, and avoid my wife calling on me to lift her filled washtubs. This means small machinery of each and very kind, and enough income so I can buy that equipment because of the earnings or savings it produces.

We can't do this in subsistence farming where we seed by hand and till with a hoe. Usually the folks advocating small-scale agriculture are making these recommendations for the other fellow; they contemplate having no part in it themselves. Does it ever amaze you the number of agencies and propaganda sources there are which specialize on the farmer and his avocation? Just imagine a county agent for merchants and another for druggists! After listening to some of the programs offered agriculture by manufacturers, jobbers, and labor organizations, I'm strong on requesting China to send some missionaries to preach the Christian doctrine in this land of the brave and home of the free.

If there is neither rhyme nor reason to the wishful thinking in the following tabulation, then proceed to elucidate for my immediate edification — I'm trying to invent a program for our Committee on Postwar Objectives:

1 A set of motorized farm implements powered by a motor shifted from one to the other by a simple hoist in 15 seconds time — 20 seconds is too long.

2 A leveling suspension for tillage implements working on steep hillsides when following the contour.

3 A set of tillage implements which actually can follow a curved row without severe muscular exertion on the controls of the operator.

4 A cutterbar which can be shifted to mow between tires in shelterbelts and on one side for meadows.

5 A two-way plow which is in front of the operator.

6 A small mowing device to follow the center of the ridge and mow both slopes of a terrace ridge as well as the top. On some of our soils we must keep grass on the ridges as permanent cover and reduce fire hazard by low cover.

7 A fertilizer attachment which can operate from the plow, mower, and combine.

8 Prefabricated animal shelters which can be put up and taken down with a speed wrench plus a block-and-tackle.

9 Prefabricated freezing units which can be set in any wall with one side flush and insulated to withstand direct sunlight.

10 Flyproof electric bulbs. More use of recessed fixtures, cased-in wiring.

11 Dust protection for feedhouse motors, with ready cleaning.

12 Adequate provision against water logging of hydropneumatic tanks. In seven installations out of ten the air supply is neglected or inadequate in design.

13 All bearings lubricated for the season by reservoir or packing.

14 More attention to building arrangement and travel routes of farmsteads.

PREFABRICATION OF DWELLINGS AND READY CONVERTIBILITY OF OTHER FARM BUILDINGS

15 Prefabrication of dwellings on designs to include wiring, plumbing, and air conditioning integral with the structure — not afterthoughts to be attained by cutting and hacking in the usual manner.

16 Ready convertibility of buildings from one service to another; this is an essential part of the general scheme of prefabrication.

17 Fire-resistant materials and methods of assembly to augment placing hazardous units closer together for sake of travel and convenience.

18 Provision of fog-making sprays readily operated by motors, already in place, as a fire precaution. Usually portable units on two rubber tires are most readily made available, especially where spray for trees and shrubs of the small homestead is contemplated.

19 A vast extension in the use of "little water"; fish ponds, reservoirs, the individual garden and lawn irrigation unit, silting basins, and stream retards (dams with tile outlets which fill during rain and drain at a modest rate).

20 More attention to lightning protection, both for buildings and fence lines.

21 The whole subject of farm debris disposal needs elaboration; the scrap metal, glass, tin, and divers other useless scrap is a menace to mowers, waders, and livestock, not to mention sanitation and beautification projects.

22 I wish our telephone and power lines were not highway juxtaposed. The tree hacking, radio interference, unsightliness, and winter humming are noxious to gentlemen of culture and refinement. We better have our driving safe from fence to fence. Wayside waterways ought to be so smooth from concrete to boundary that anybody can abandon the track to spirited drivers who need all of it! The rule here is, never get under thirty-five unless coming to a dead stop.

23 The subject of agricultural engineering curriculums is up for review; we are busy stalking the culture in agriculture, and trying to inject economics, language, and decency into an already overloaded schedule — all without cutting a single hour or prerogative of any engineering department anywhere. Here, my educational associates, is a real objective! We've got to the place where we propose to tell the others just what to teach and how to teach it; this will put the engineering brand of approval on everything.

Thus ends this epistle! I am counting on your reply to elaborate on what I overlooked, disregarded, or misused, along with such comments on my mental status as you feel justified in dictating to a genteel typist.

LESLIE E. HAZEN

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Oklahoma A. and M. College, and
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Vertical Farm Diversification

(Continued from page 62)

Statistics show that for every $1.00 of agricultural income there are about $7.00 of income for urban people. Therefore, any increase in annual income for farm folks through vertical farm diversification can be expected to be multiplied seven times in the increased income to city labor and business.

There will come out of this war a host of rural youths highly trained mechanically. They will have the urge to return to the farm. They will need new ideas and progressive programs to challenge and hold their interests. They will have the mechanical ability to operate the "farmfacs" and rural industry. It will be extremely important that they find on farms, and in rural communities, opportunities for work and expression of abilities. The alternate drifting to the cities, that will already be badly overcrowded, will add to the vicious national problem of unemployment that is certain to come with the return of peace.

The place of the agricultural engineer in this program of vertical farm diversification and rural industry is clear. Frank J. Zink expressed the challenge thus in an editorial in AGRICULTURAL ENGINEERING for February, 1944 (page 38): "It is my belief that rural industry awaits the engineer for its development and growth. In my opinion it calls for some new thinking by the group which feels that the job belongs to it. As now appears, I think it may as well be the agricultural engineer's job, primarily because rural industry deals with agricultural raw materials, and in many cases the operations are such as to prepare them for the farm consumer; that is, the product goes directly back to the farmer."

Certainly this is a program on which all can work enthusiastically, both town and country folks. Its successful achievement means added national prosperity. Of most importance it will give added stability and more income to farmers who socially, politically, and economically are the balance wheel of the nation.

Farm Ponds

(Continued from page 64)

tributing watersheds to prevent the pond filling with sediment and to maintain clear water in the pond at all times. Silt laden water is not suitable for fish production and the filling of a pond with erosion debris may soon render it useless for other purposes.

When fish reach maturity they should be caught out of the pond. Since the amount of growth is dependent on the food supply, small fish have little chance of increasing in size where a pond is overstocked. The removal of mature fish makes food available for the smaller ones to grow on to maturing. Should the population be thinned down by heavy fishing, the increased food supply for those remaining will make them bite less, thus allowing them to replenish the pond population. Therefore, continued production in a pond actually requires regular removal of mature fish.

SUMMARY

1 A small pond is a desirable asset to a farm.

2 Proper construction procedures make future management easier.

3 Top width is a more important specification than face slope on a small dam.

4 A pipe should be placed under the dam for draining pond.

5 Adequate spillway capacity and protection are absolutely necessary in safe pond construction.

6 Shallow areas should be eliminated from the pond.

7 Special features such as use of water for irrigation and livestock watering should be provided for when the pond is constructed.

8 Fish production in ponds depends on proper stocking, food supply, flood control, weed control, erosion control on the watershed, and removal of mature fish.

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Farm Applications of Bactericidal Lamps

By L. P. Veloz

SPECIAL forms of ultraviolet lamps developed for the medical profession for the purpose of combating air-borne infection are continually finding new farm applications, and it appears that farmers will become large users of these lamps.

Bactericidal lamps made in various lengths are a slender cold-cathode lamp about the diameter of one's forefinger. Through the use of a low-pressure mercury vapor arc within a very special glass, a lamp has been developed that transmits a large portion of its energy in the bactericidal ultraviolet band. These lamps operate on alternating electric current only, and the 30-in lamp consumes approximately 16 w. Since they have no filaments to burn out, the life expectancy of these lamps is 5,000 to 6,000 hours. Bactericidal lamps are not to be confused with other available ultraviolet sources, such as the sunlamp, which have little or no bactericidal value, or the high pressure quartz lamp the output of which is over the entire range of the ultraviolet and visible spectrum.

Perhaps the most important agricultural application at this time is one in the poultry industry, important because of the tremendous losses poultrymen incur every year as the result of mortality due to diseases. Dr. T. C. Byerly, senior poultry husbandman, U. S. Department of Agriculture, before a poultry industry conference on July 26, stated that the industry loses 150 million dollars a year due to the ravages of disease, and that this represents a cost of two cents on every dozen eggs produced and two cents on every pound of poultry produced. In all phases or stages of this business, that is, in the hatching, brooding, raising and egg laying, there is one common problem involved which is not overcome by good housekeeping or sanitary techniques, and that is the problem of preventing or reducing air-borne cross-infection, between the chicks or flock, so largely responsible for the epidemic spread of disease in poultry houses.

When properly installed in the hatching compartment and the room in which the incubator is located, bactericidal lamps reduce to a minimum the possibility of cross-contamination between the hatching chicks due to the rapidly circulating air within the hatching compartments. The use of these lamps is recommended in the incubator room because, in the great majority of the cases, contaminated air from the hatching compartments is exhausted into this room which serves as a fresh air supply for the incubator. An equally important reason is that this highly contaminated air can act as a source of infection for the rest of the plant. It is further recommended that the lamps be used in the sexing, shipping, and sorting rooms for the complete protection of the chicks against air-borne infection until they are shipped. Hatchery men, who have used the lamps for the past year or two, tell us that the protection afforded by these lamps has materially increased the viability of their chicks; and this has not only built up good will for them but resulted in considerable savings.

Government bureaus tell us 60 per cent of all chick mortality is within the first 16 days. This then applies to the nursing or brooding stage which in many plants is combined with the raising to broiler size. Whether raised on the floor or in batteries, the acute congestion during the first two to four weeks of a chicken's life offers an ideal opportunity for the rapid spread of air-borne disease. The germ killing rays of the bactericidal lamps continually disinfect the air, offering the utmost in protection against the spread of air-borne epidemics.

A secondary benefit, perhaps as important as the reduction of mortality, is the added vigor and gain in weight the birds acquire. They feather out faster, and the plumage is better; the combs are deep red and erect; the pigmentation of the legs appears sooner and is more noticeable. Part of these benefits is undoubtedly due to the small amount of vitamin D producing energy with which they are continually being irradiated. The bactericidal lamps produce as a by-product a very small percentage of their output in the vitamin D part of the ultraviolet spectrum.

Large operators, who have run controlled tests, tell us that the use of these lamps has reduced mortality in their flocks 50 to 70 per cent. They have been able to put their birds on the market up to two weeks sooner and they have fewer runts and culls. One of the largest operators in the Middle West writes: "In a control test of two identical houses we found approximately 68 per cent lower mortality in the house using bactericidal lamps . . . . the number of culls and runts in the final birds was 50 per cent less . . . . we raised 1000 pullets per battery, instead of 750 where these lamps were not used . . . . pigmentation of combs and legs was noticeably better . . . . no mold whatever developed in watering pans exposed to the lamps. . . ."

Conditions found in egg laying houses are very similar with this exception: mortality at this stage can very seriously affect the farm income not only because the laying bird is worth more, but the loss of revenue from its egg production can run into a great deal of money. Here too, bactericidal lamps offer the utmost in protection against the spread of air-borne epidemics and in addition exert a beneficial effect on egg production.

Tests conducted in egg laying houses have shown a tendency to level out the peak and valley of the egg laying season with total gains as high as 10 to 15 per cent, the interesting point being the greatest gain in egg production came about the time when eggs were at the highest market price.

The development of this application came so fast that there was not time for accredited institutions to make the tests that would have normally preceded any widespread acceptance of these lamps in the poultry industry. Much of this work has now been started by various institutions and undoubtedly more will be done in the future. However, the practical results obtained in the field by the poultrymen speak for themselves, for the thousand and more installations that have been made in the past two years have been without solicitation and promotion on our part. To illustrate, here is a statement from the Calhoun Poultry Farm & Hatchery, Montrose, Missouri: "We have used bactericidal lamps in our battery building (capacity, 40,000) for the last three years and have obtained excellent results. We installed these lamps for the purpose of eliminating the common cold which is so prevalent in battery brooding plants. Although the lamps did not entirely prevent the occurrence of colds, it did cut the prevalence 75 per cent and added benefits which we had not planned on getting, namely, larger, more energetic birds, better coloring and a lower mortality loss. It is easy to see, by a comparison test, the benefits derived from the use of these lamps. All that is necessary is to compare a chick raised under these lamps with a chick not raised under them; the former is so far superior."

In the dairy industry there are several excellent applications for it is a business where sanitation pays off. Starting in the maternity and cow barns, by materially reducing the bacteria and virus in the air, bactericidal lamps minimize the chance of respiratory cross-infection and in this way promote more healthful conditions in the barn.

Just as important is the control of air-borne bacteria in the milking room. It is here that organisms settling out of the air come in contact with the milk and milk pails forming a large part of the initial contamination; a few ceiling-mounted lamps are all that are needed in most cases to relieve this condition.

Pretty much the same condition holds true in the utensil storage rooms. Here equipment and utensils after being washed and sterilized are stored till the next milking time. One bactericidal lamp in the average small room will permit virtual sterile storage of the milking equipment. Another popular use in this room is to take two of the standard fixtures and by bolting them back to back you have a practical, efficient and portable milk can sterilizer. Inserting the lamp unit in the milk can for a few minutes does the job.

In milk processing plants, as an aid to bacteria control, they should be used in the pasteurizing room and over the bottle conveyor. Where butter churning is done, this area should be included. A great deal of research has been done and is now being done on pasteurizing milk with ultraviolet rays but to date no practical solu-

This paper was presented at a meeting of the North Atlantic Section of the American Society of Agricultural Engineers at New York, September, 1944.

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tion to our knowledge has been developed. Ultraviolet radiations have extremely limited penetration through material as opaque as milk. The intensity required to sterilize it is sufficient to cause deterioration of the fats and proteins thus producing an off taste.

There are many out-of-the-ordinary applications in almost all industries, such as in the milk processing plant in Gustine, California, where due to a secret pasteurizing process they say their cream after bottling can be held at room temperature for more than a year, bactericidal lamps being widely used in aiding and maintaining an aseptic condition.

In cheese making, which is dependent on one particular organism for a specific result, during aging and storage bactericidal lamps will protect the cheese against any unwanted molds which might affect its proper aging or give it an off taste.

There is a possibility of a good application for bactericidal lamps in hog houses. A pig, from what I have been given to understand, while an extremely hardy animal, is subject to respiratory infection, and bactericidal lamps, therefore being able to destroy the organisms responsible for these infections, are doing a good job.

Refrigerated food storage plants, both large and small, make a good application for here the problem of food preservation is involved, and since food preservation is largely a matter of bacteria control, these lamps can be a valuable aid. Our experience with this type of application goes back five or six years with almost every conceivable type of food. How widely this application has been accepted can best be illustrated by the fact such chains as Kroger Grocery Company has 1500 of their meat and grocery stores equipped.

In the case of locker storage plants, the problem and solution are the same as in storage coolers. Bactericidal lamps should be installed in the receiving, processing and aging rooms, and while there are several hundred plants so equipped, we do not believe this application has received the attention it deserves for it is obvious that the better the condition of the meat before it is frozen, the better it will be at the time of use.

USE OF BACTERICIDAL LAMP FOR THE STERILIZATION OF WATER SUPPLIES

In all the applications I have discussed in the foregoing the problem has been one of reducing air-borne and surface contamination. I want to discuss now a different type of problem, that is, water sterilization. Since clear water, whether from a well or tap source, has better than a 50 per cent transmission to a depth of 6 in, large quantities of water can be sterilized in relatively short times with one lamp. The most practical method of doing this is to build a shallow trough with a bactericidal lamp located two or three inches above it. Water passing under the lamp at a given rate of flow would be virtually, if not actually sterilized. As water from different sources varies widely in transmission, it is essential to have tests made before making an installation. The needs for pure water on a farm, in addition to that for drinking purposes, are numerous. As an illustration, Pacific Coast farmers prior to packing are now washing and cooling their vegetables with refrigerated water. Because of the large quantities of water involved, it is impractical from an economical standpoint to use all fresh water. Any attempt to filter it and recirculate brought on trouble as in a few minutes the bacteria count of the water was so high as to be dangerous. The solution was found in using a half dozen bactericidal lamps over a simple trough as I have described. Now the water can be recirculated many times before it is discarded.

An important use for these lamps is going to be for the protection of the farmer and his family. It is obvious that, if we can reduce the bacteria count in the air and in that way create a more healthful environment for the farm livestock, the same would hold true for human beings for they too are susceptible to respiratory infection. Consequently our company has developed a shielded type of unit for use in homes and schools. This is a portable plug-in device that needs merely be hung on the wall at about a six-foot level. Tests have been conducted by various agencies over the past several years and have shown remarkable results. A report published this year on results in six Pennsylvania schools showed a reduction of from fifty to seventy per cent in measles, mumps, and other children's diseases in those rooms using ultraviolet. Many more experiments are now in progress and in the next year or two a great deal of additional information will be available on this subject.

In conclusion, here are three main points to remember about bactericidal lamps:

1 Where air-borne bacteria is the cause of illness, mortality, or product spoilage, bactericidal lamps can be of service.

2 The basic application of this lamp is the treatment of the air and not the product, except where clear liquids and smooth surfaces are involved.

3 Clear liquids such as water, and to a lesser degree some others, can be effectively sterilized.

Ag Engineer Speaks from the Farm

TO THE EDITOR:

ANOTHER year has passed. The farm situation is getting no better fast. The labor shortage has made it impossible to do things as they should be done. It is a question of doing the most important things and letting the least important go. On top of the farm work I have been a member of the AAA county committee, vice-chairman of the Farm Bureau county unit, chairman of the district soil conservation board, and representative to the state land-use planning committee.

We have 90 head of cattle ready to go to the Denver livestock show, and have some 200 head more to go into the feedlot soon. The wheat is up to a fair stand and we are trying to get ready to irrigate about 200 acres of it. We also want to irrigate some 200 acres for silage and grain sorghum some time after the ground thaws out. We have about 100,000 lb of certified sweet sorghum seed to get ready for final certification.

There is much interest here in irrigation farm wells, grain driers, cattle grub sprayers, sorghum storage, and cattle handling equipment. All these are important fields of agricultural engineering.

I am no longer connected with the colleges but I am interested in their work. I have tried to attend the agricultural engineering extension sessions held out over the state. I am somewhat disappointed in the results and the presentation of material but know how hard it is to tell experienced men how to do things, especially when the agricultural engineers available are relatively young and inexperienced. I was guilty of the same mistakes, I am sure, when I was in college work.

My viewpoint has changed considerably since I came back to applied agricultural engineering. One of the things we as farmers want to know is how to modify existing equipment so that it will do better work, how to build new buildings and equipment, and how to maintain our present equipment. A farmer has a hard time getting this information. A few farmers will write for it, quite a few go to the county agent, and many just go ahead. I can see now that the mistake that many of us made as college representatives is that any one technical field is only a small part of a farmer's business; we treated it as though it was the most important part of his business.

Many farmers would like to see some of the articles in AGRICULTURAL ENGINEERING but they read "Country Gentleman", "Capper's Farmer", "Successful Farming", and the like. I feel that ag engineers are missing a bet in not writing more popular articles of the conservative but practical type. We need a Sidney Cates or a Paul DeKruif of ag engineering.

I know you are extremely busy and I know this letter has taken some time, but hope that it will give you another indication from "the other side".

DONALD CHRISTY

Ag Engineer — Farmer, Scott County, Kans.

A World Need

THERE is great need of soil and water conservation work throughout the world. Flood control is a necessity for many areas. Many nations want American-trained men — agricultural engineers chiefly — and they state quite frankly that they do not want simply construction engineers, but, rather, men who know agriculture as well as construction. This looks like an opportunity for development in the agricultural engineering profession and it would seem good strategy for the profession to determine how it can grasp this opportunity of world leadership and begin to train young men for it. The strategy of such a move from the viewpoint of the manufacturer is obvious.

Relation of Engineering to the Manufacture and Distribution of Farm Electric Equipment

By C. V. Holman
MEMBER A.S.A.E.

ONE OF the finest compliments to be paid to the agricultural engineer may be found in the Federal Trade Commission's summary of distribution methods and costs to the farm equipment industry, dated March 2, 1944, in which it is stated that the studies of the U. S. Bureau of Agricultural Economics show that man labor in the production of wheat in the five-year period, 1928 to 1932, was 43 per cent lower than in the five-year period of 1898 to 1902; that it was 29 per cent lower for corn and 17½ per cent lower for cotton. We are certain that the reduction of man labor in the production of other agricultural products will show similar decreases, due in greater part to the work of the agricultural engineer.

It is an established fact that the prosperity of the farm equipment industry — in fact, all industry — depends on the prosperity of the American farmer. As was so aptly expressed by "Fortune" magazine, "The farm is still the broad enduring base upon which the entire United States economy rests." Past experience by manufacturers of farm equipment has shown that as the farmer's income fluctuates so does the movement of machinery into his hands. It follows, then, that by designing agricultural implements that will bring larger profits to the farmer, through lowering his production costs, the engineer contributes greatly and directly to the well-being of the farmer and, in turn, to the growth and progress of the country as a whole.

Another phase of this contribution to an improved position for agriculture is the fact that our industry has passed on to the farmer new machines and refinements in machines at a low profit to the industry. This is borne out by the report of the Federal Trade Commission just mentioned. The Commission states that a study covering 76 manufacturing industries in 1939 and 86 in 1940 shows that the margin of profit was relatively low in the agricultural implement industry, compared with the profits of other manufacturing industries.

It is well recognized that a great danger to the American farmer is the continued disparity between prices of the items he produces and the prices of many items that he purchases. The agricultural engineer and the farm equipment manufacturer working to design labor-saving equipment that will bring larger returns to the farmer, and distributing these items to him at a low profit, are combatting this economic menace to the American farmer.

I have felt it appropriate, and justly due the agricultural engineer and the farm equipment industry, to make the foregoing remarks before entering into the subject of this paper.

I believe my subject can best be discussed by considering, first, the relation between engineering and the manufacturing division of the farm equipment industry and, second, the relation between engineering and the distribution division of the industry.

RELATION OF ENGINEERING TO MANUFACTURE

1 In the relation of engineering to the manufacture of farm electric equipment we recognize that, as a first consideration, engineering has the responsibility of research in finding new fields where electric equipment can be operated and in extending the uses of present equipment into other fields. This is an engineering activity highly important to the manufacturer, for it means new products to manufacture and new markets for older products.

As agricultural engineers you are familiar with the many applications of electricity to farm equipment that have come out of engineering research, such as electric pumps, electric fencing, electric drives for cream separators and churns, the mechanical milker, and the adaptation of refrigeration for cooling milk and other products on the farm.

This paper was presented at the annual meeting of the American Society of Agricultural Engineers at Milwaukee, Wisconsin, June, 1944, as a contribution of the Rural Electric Division.

C. V. HOLMAN is manager, dairy equipment refrigeration, wagon and engine sales, International Harvester Company.

But these and other products of engineering research already designed and in common use will be followed by more innovations in electric farm equipment, and we in the farm equipment industry believe they will come soon. We believe the war has opened up new fields for the application of electricity in industrial applications that can also be engineered into equipment for the farmer.

An example is electronic welding. The farmer has long needed a small, efficient and *safe* method of welding equipment on the farm. It seems certain that the engineer could apply much of the knowledge in electronic welding gained by research in the present emergency to the development of an electronic welder than can be used by the farmer even in his barn or machine shed without the hazard of fire.

Seemingly open to development also are adaptations of automatic controls to many pieces of now manually operated farm electric equipment. Such development would prove a boon to the farmer and would increase the manufacture of these items. These are examples indicative of a broad field of possible adaptations of electricity to farm equipment.

2 Along with research as a principal consideration in the relation of engineering to the manufacture of farm electric equipment goes the matter of basic design. The engineer of course has sole responsibility in the basic designing of farm electric equipment. He must design equipment so that it can be made at a satisfactory manufacturing cost, yielding a profit to the manufacturer. At the same time, the engineer must design the equipment so that it will perform satisfactorily over a reasonable period of time. For example, all farm electrically operated equipment should be equipped with *positive overload protecting devices*. This should apply to all complete machines as well as separate motors used on farms. The reasons for it are obvious, such as fluctuating voltage, lubrication failure, and mechanical overload.

3 A third principal consideration is one that has not been stressed greatly up to now. It is the matter of "field service". We believe all farm electric equipment must be so designed that necessary service operations can be performed at the dealer level, that is without necessity of returning the equipment to the manufacturer. Several of the larger manufacturers of farm electric equipment are contemplating the redesigning of their equipment so that this can be achieved. It will be necessary also for the agricultural engineer to provide farm equipment dealers with a course of instruction in servicing farm electric equipment. Today a very small percentage of the farm equipment dealers are in a position to render adequate service on farm electrically operated equipment. Yet it is obvious that when equipment must be returned to the factory for repair the service cost is unduly high and the inconvenience to the equipment owner is great. We cannot overstate the importance of correcting this situation, and it is a job for the agricultural engineer. We feel he should concern himself with the serviceability of equipment, even to the component parts such as electric motors and controls. The agricultural engineer should obtain the cooperation of electric motor manufacturers in designing motors with parts that can be replaced by a dealer who has mastered a simple course of study covering service — a type of service that would require a minimum of electrical test equipment.

You may judge this job of bringing the service of electrical equipment down to the level of the farm equipment dealer as a major undertaking, but our company has done it on electrical equipment for tractors, trucks, and even diesel engine service to the point where the larger percentage of our farm equipment dealers are now in a position to render satisfactory service on these classes of equipment. It has without question put a considerable load on the engineer to simplify his design and produce test equipment and to set up, as well, a satisfactory program of service instruction.

We are firmly convinced that the future of the farm equipment electrical industry is about equally dependent on engineering re-

search, low cost basic design, and adequate field service. The industry will progress in accordance with the advances made in these categories.

RELATION OF ENGINEERING TO DISTRIBUTION

Now as to the relation of engineering to distribution. The very fact that large-volume distribution for many items of electrical farm equipment has been developed over a short period of time is proof that there has been sound engineering behind the program. Without adequate engineering it would not have been possible to achieve the large distribution of this class of equipment.

More than any other factor the designing by the agricultural engineer of the "package unit" type of farm electrical equipment has been responsible for the wide distribution of this equipment. One of the worst stumbling blocks to widespread distribution in the past was the installation often required on farm electrically operated equipment. In many instances "factory trained" assistance for the dealer was required before installation could be completed. It has been the experience of the industry that where installations are complex, the dealers will not go to the effort to sell the merchandise, as they feel that the "mysteries of electricity" are too much for them.

The package-unit type of manufacture has many outstanding advantages. Among these are (1) complete fabrication at the factory, (2) a minimum of installation required, (3) low production cost, (4) pleasant styling of exterior, (5) low cost service and parts available at the dealer level, and (6) dealer sales activity.

THE REFRIGERATION INDUSTRY HAS MADE MUCH PROGRESS

It is our conviction that the refrigeration industry has made more progress in this direction than any other in the field of electrically driven equipment purchased by farmers. Practically all items of refrigeration equipment purchased by farmers in volume either are now of the package-unit type or will be in the immediate postwar period.

In building the package-unit equipment for the farmer, it is possible for the manufacturer to exercise control over the adjustment of equipment and to operate it at the factory prior to the time of its delivery to the dealer and to the ultimate consumer. This means that any electrical controls involved can be given final adjustments and that the equipment can be carefully checked as an operating unit, thereby eliminating many profit-sapping postsale trips by the dealer to the farmer to adjust equipment after it is once installed.

We feel that engineers might well keep in mind this progress of the refrigeration industry in package-unit type of equipment and emulate it wherever possible, for it is well known that considerably over 90 per cent of all refrigeration equipment of the package-unit type delivered operates satisfactorily through the warranty period without a call back by the dealer who has sold it.

The answer to successful distribution of any class of equipment *is profit for the dealer.* When a dealer has a profitable line, relatively free of postsales service, he will apply the necessary time and effort needed to merchandise it in quantities to his farmer customers.

Here again we must emphasize that *it is also engineering's responsibility to distribution to provide it with equipment that can be serviced by the dealer if necessary with a minimum of special tools and special instruction.* It will be necessary that engineering devise a simple course of study for dealers so that the servicing of farm electrically operated equipment will no longer be a major problem. The farm equipment dealer has, in the majority of cases, already mastered the intricacies of internal-combustion engines of both the gasoline and diesel types. There is no reason why he and his organization cannot take on electrical service in so far as the repair and maintenance of equipment sold by him are concerned. He will take it on as soon as engineering provides him with the necessary instructions.

Another responsibility of engineering to distribution is research in new applications for electrically operated farm equipment and machinery, and subsequently the designing of machines to meet these specific applications as they are devised and developed. This is one of the very important obligations of engineering to distribution, because obviously these new applications will be the means of further lightening the farmer's work load.

Past experience has proved that where electrically operated farm equipment can be given fully automatic control, it enjoys almost immediate acceptance by farmers. It is difficult for many farmers to see any great advantage in having electric power over other forms of power for their work unless that power can be harnessed and operated by fully automatic control. Take, for example, feed grinding. Statements by many farmers would indicate that to them the advantage of an electrically operated hammer mill that is manually controlled over an engine-driven hammer mill is not greatly important. This is particularly true when it is considered that most farmers already have other sources of power available. However, if this same farmer were offered a completely automatic hammer mill or feed grinder which would operate without attendance, he would then immediately become interested in an electric-driven hammer mill or feed grinder.

We are certain that this same reasoning will hold true with regard to practically all farm electrically operated equipment. Automatic operation is desired.

CONCLUSION — RELATION OF ENGINEERING TO MANUFACTURE

1 *Research.* Engineering must discover new uses for existing machines now in service. It must also design new equipment to handle problems arising from time to time for the farmer. It must adapt as far as possible to provide automatic control on all farm-operated equipment.

2 *Basic Design.* Farm electrically operated equipment must be so designed that it can be manufactured at a satisfactory cost, yielding profit to the manufacturer and a good reasonable period of service to the purchaser.

3 *Service.* The engineer must design farm electrically operated equipment so that the service problem will be reduced to a minimum.

CONCLUSION — RELATION OF ENGINEERING TO DISTRIBUTION

1 *Package Unit.* The package-unit design of farm electrically operated equipment will secure dealer activity by eliminating most of the installation and postsales trips covering minor adjustments by the dealer. This results in larger profit to the dealer, and hence more energetic sales activity.

2 *Field or Dealer Service.* It is the engineer's responsibility to distribution to provide completely serviceable equipment. This equipment must be so designed that the dealer, with the aid of simple instruction and simple test equipment, can make field repairs and adjustments of equipment without the necessity of having it returned to the manufacturer.

3 *Automatic Control.* The adaptation of automatic electric control to farm electrically operated equipment will do much to arouse interest among the farmers and so widen the market.

Helping the Farmer

VARIOUS individuals, groups, and agencies are concerned in one way or another with farm building construction. Of course, the farmer is primarily concerned, but he must look to economists for advice as to reasonable investment limitations, to engineers for sound designs, and to industry for standard materials and for the development of newer, more adaptable materials.

There are two ways for each of these contributors to look at this job. One, empirical, cut and try, follow the old ideas; the other, rational, reasonable, the determination of new solutions for problems, which may not in themselves be new but which undoubtedly will be presented in new settings.

The fact that farmers are busy feeding the rest of us makes it imperative that they spend their time at the job of producing and leave to those better qualified the job of providing them with their facilities, their tools of production. Rest assured the farmer will demand this service. Therefore it is reasonable for all concerned to prepare now to meet the demand. Let the economists stop worrying about construction costs and concentrate on reasonable investment ceilings. Let the engineers rationalize their technique so as to provide a base for operations that is acceptable. Let the extension agencies extend the engineers' contributions to those who will put 90 per cent of the design ideas into concrete form, the rural dealer and contractor. Let the industries provide the materials and recommend proper adaptations through their normal outlets, the dealer and contractor, and finally let the farmer know by every avenue possible that a sound body of advice and service is available to him whereby he can be relieved of what up to now has caused him many headaches, so that he can concentrate on his real job of efficient production.

Extension Work for Better Farm Housing

By S. P. Lyle

FELLOW A.S.A.E.

IN THAT inspiring and lovely hymn, "America, the Beautiful", by Katherine Lee Bates, appears the prophetic line, "Thine alabaster cities gleam, undimmed by human tears," which relates the ultimate contribution of architectural and engineering service to complete human happiness. As architects and engineers for rural America, the beautiful, we need the counterpart of that vision in farm housing. In cooperative agricultural extension work we foster the self-expression of that innate desire for beauty in the home, in the community, and throughout the Nation. We strive to reach and aid every farm family however humble, extending understanding, guiding hands to transform unsightly or unsuitable houses into the beautiful and modern homes which can become reality on every American farm. Extension agricultural engineers, in private as well as public service, have an unique responsibility and opportunity in the fulfillment of this possibility. Let us continue to extend our vision like that of the hymn, beyond the services of our personal assignments.

"Farm housing" recently has acquired a broader meaning than urban housing. Of course it brings to mind first the farm dwelling, but because we wish to be free of slum farmsteads as well as to improve farm dwellings, we think of the architectural and engineering problems as requiring a unified housing service. Buildings making up a farmstead house not only people but also livestock, crops, and equipment. Because the entire arrangement and construction of buildings requires a unified plan on a farm, it is practical to provide through county extension offices advice on any aspect of the housing problems with which farm families are confronted.

Two other terms have long been used with this same broad meaning, namely, "farm structures", and "farm buildings". The similar meaning being given to "farm housing" is used here in connection with extension work because it places more emphasis on the dwelling, and also on the function of the structures or buildings, implying coordination of the whole farmstead housing problem in relation to farm life and the farm business.

As an aid to farm families, extension work for better farm housing includes educational help in related aspects of home management, home furnishings and home equipment, in livestock management as well as general farm management, and is concerned with the equipment and beautification of the buildings and grounds, as well as with harmonizing the architecture of the buildings and providing information to assure sound functional and economic construction.

"Better farm housing" is a relative term which looks continually toward improvement. American farm housing has progressed through various stages from the primitive pioneer structures of logs in the forested areas, and sod houses on the plains, to frame and masonry houses which throughout the country can be "typed" by the periods in which they have been built. American farmers are progressive and have always sought improvement. They have been an important part of an enterprising people who have continuously modernized the facilities and services for farmers as well as for the urban portion of our population. In brief, farmers, along with all other Americans, have been provided with new developments in housing merchandise and services and have eagerly undertaken to make good use of them. Today a farm home can be more comfortable and better equipped for living than kings' palaces were half a century ago. Today farm service buildings also are being constructed more nearly in accord with sound functional standards than ever before.

Extension work in farm housing is a part of the comprehensive educational service for farm people. Farm and farm living problems of all kinds are brought to the county agricultural and home demonstration extension agents. We seek to meet these requests for aid through the use of extension specialists who bring to bear on local problems the knowledge and resources of science and practical experience. We aid the farmers in the progress they themselves seek to achieve. Improvement in farming practices, including farm housing, was notable before the cooperative extension work of the U. S. Department of Agriculture and the state agricultural colleges was established. The extension work was inaugurated at the request of farmers to enable them to accelerate their rate of progress. Extension workers have from the inception of their assignment been impressed with the importance of improving farm housing in its broadest sense not only to increase income but even more to make American farm homes the happiest homes in the world.

Mobilized for Victory. Though that is our purpose in doing extension work for better farm housing, such a program in wartime must be mobilized for victory. Our farmers have fought for freedom by furnishing abundant supplies of food. Record-breaking food production for four years for defense and for war has become the rule. From the start, increased housing and storage facilities have been needed to house increases in production. New construction has been needed for hundreds of millions of bushels of new storage capacity. Conversion of old barns to new uses has been necessary on a vast scale. Repair and strengthening of buildings has also been more necessary than usual, for all the old buildings must be made to last for the "duration" because materials and labor are scarce and increased farm building capacity is in great demand. Such has been the most prevalent farm building utilization, maintenance, and repair work for victory, but there have also been the housing of laborers for farm work and the replacement of buildings lost or damaged by fire, wind, and flood.

Cooperative extension work is educational. It expends no money on housing except in a very limited way in the farm-labor program, and conducts no construction work for farmers, but it has been ready and working in every agricultural county in the entire country to meet the wartime building problems of farmers with construction plans and advice. Part of this service has been available for 30 years. All of it was strengthened in the regional revision of farm building plan service inaugurated by the Midwest Plan Service and completed in the North Atlantic, Western, and Southern Plan Services through the cooperation of the state agricultural colleges, the Agricultural Engineering Structures Division, and the Extension Service of the U. S. Department of Agriculture. All these agencies have also combined their efforts when needed during the war to cooperate with the War Food Administration and the War Production Board to aid farmers to meet the housing requirements for food production under the necessary limitations accompanying expanded war production. Part of our work has dealt with the use of alternate materials and construction design, in which manufacturers have rendered a tremendous war service. Not only have they supplied the needed materials, but also through dealers and other services and through advertising they have encouraged sound and satisfying construction. Much of this war work is too familiar to this audience to warrant detailed description.

The Present Situation. The present situation is of more interest. Apparently farmers are eager to catch up with their building and repair needs and are limited more by the lack of labor than by lack of lumber for essential wartime construction. Doubtless an acceleration of farm building construction and repairs will occur, however, when war limitations are eased. Many farmers will seek to improve their homes first, others will make long-delayed changes in service buildings to improve their income value, and others may defer their service building plans until they revise their farm management to meet postwar production and marketing opportunities. We are, however, still in a war production situation, looking forward to further increases in some of the rationed food commodities which will require further conversion of farm buildings for war use.

A more abundant supply of all the foods required in a well-balanced national diet should become available and be maintained after the war. America has discovered during this war the nutritional basis for food production. Farm buildings are essential in such a program. Soil erosion and depletion we have recognized and will control, but human hunger, especially "hidden hunger", has received a recognition during the war which we cannot and will

This paper was presented at a meeting of the North Atlantic Section of the American Society of Agricultural Engineers at New York, September, 1944.

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not ignore in time of peace. The function of farm buildings in furthering adequate food production will be developed as has never been done before.

Extension Programs Going Forward. Here are a few things extension workers are doing in the war:

First, the state agricultural colleges of this (northeast) area held a conference last fall (1943) following the meeting of this section of A.S.A.E., at which they began the revision of their regional plan service. It is now in process of completion in cooperation with the U. S. Department of Agriculture, and poultry and other specialists are cooperating with the agricultural engineers.

Second, the federal department and the state colleges have continued to cooperate with the War Food Administration in the development of special plans for the storage of essential food and feed supplies. The most recent work relates to the storage of soft corn and grain sorghums this fall. Preceding that was the widespread service on barn hay drying, introduced by the Tennessee Valley Authority and spreading through college development and testing into new areas. Industrial service has aided and expedited the procurement of essential construction supplies for the hay drying equipment.

In addition to planned construction work, general maintenance and repair work was accelerated as compared with that done last year. No doubt the repair campaign, in which numerous organizations have cooperated, contributed to this and was helpful to farmers through suggesting means of getting this essential work done. Most of this construction was probably done with individual purchases of material less in amount than the war limitation restrictions. However, it is interesting to note that little more than half of the one billion feet of lumber allocated to the War Food Administration for issuance to farmers during the third quarter will be issued by the end of the quarter, September 30. High prices and the low grades of lumber available may have contributed to the lack of demand for this supply, but the use of other materials is a very evident factor and farm-labor limitations this summer are too obvious to overlook as a limiting influence on larger construction plans.

Emergency Service. Storms, of course, have taken their toll of farm buildings and as usual extension assistance has been available, but not always to the extent that such needs warrant. Not so in Wisconsin, however, where the state extension service has given years of development to servicing the special building needs of farms. On June 22, a tornado sweeping across Lafayette County, Wis., destroyed or damaged buildings on about 60 farms. The college of agriculture, through the extension service, set up a planning service in the county courthouse, and by the end of the month 50 farms had been signed up for service and farmsteads had been planned for twenty of them. The value of this almost instantly available emergency service is readily apparent with reference to its relief value to the community and its support of the food program. Its outstanding value, however, is in its permanent contribution to the improvement of the buildings and their relocation on the farm to serve best the farm business and home living opportunities of each farm for years to come.

Variations in Activities. Time will not permit discussion of interesting variations of work in many states throughout the country, such as converting 15 parish fairgrounds to prison camps under the direction of the Louisiana extension agricultural engineer in connection with the extension program to supply labor for farm work; or assistance with the building of community canning plants in Georgia by the extension engineer. Dairy barns and storage buildings have been built in many areas. General reconditioning of buildings is widespread.

The survey of roofing on farm buildings conducted by the American Zinc Institute in 1941 and 1942 in 36 states east of the Rocky Mountains has made available a useful measure of roofing repair needs which doubtless has relation as an index to the need for farm building reconditioning in general. It is of great interest to extension workers, some of whom aided in the survey with the purpose of making direct use of the state and county information gathered, and are using it now in current activities.

Training Program. Preparation for postwar housing work is now in progress on three levels of training, namely, for specialists, for other extension workers, and for farm families. At present the home economics workers are especially interested in furthering current research on farm family requirements in housing, and in obtaining in-service training for specialists to meet extension service needs in this field. Purdue University conducted an intensive course in rural housing at LaFayette Ind., from August 14 to September 1. The emphasis here was on farm dwellings. Those attending came from 19 states and Canada, and included 25 women and 4 men. The course was really a professional conference comprehensive in its field as well as intensive in character and utilized the talent of twenty of the university staff and 10 lecturers from other institutions and organizations.

Farm housing will be featured on the programs of numerous state and district meetings of county extension workers this winter to prepare the way effectively for housing work among farm people. The Nebraska extension proposals for in-service training meetings were circulated among the county extension agents this summer in check-list form, which gave each agent the opportunity to express preference for detailed subject matter and the type of training meetings desired for dwellings and for other farm structures problems.

The training throughout the country is in the direction of simplification of techniques and the use of models to supplement blueprints. Drawings with scale development of sloping surfaces such as roofs permit mounting the blueprints on cardboard, which can be cut out and the elements of the construction assembled in a three-dimension detailed scale model. This can be handled in a way which removes much of the mystery from construction drawings. However, much of the work of the near future will require more skilled workers, and we are looking forward to the need for training workers whom we hope will soon become available for the construction work ahead.

Outlook for Service. Various estimates have been made concerning the construction of housing after the war. The housing survey of the Twentieth Century Fund, Inc., New York, as reported in "American Housing, Problems and Prospects" contains the statement, "Figures in this survey indicate a potential postwar demand for well over 1,000,000 units a year during the first decade after the war." An estimate of annual farm dwelling construction and remodeling if placed at one-fifth of this amount, would be the equivalent of 200,000 dwelling units. This would be about one new dwelling for each of 30 farms. To this should be added other farm building construction, remodeling and repair work. The total figures would not be out of line with prewar dollar volume estimates of farm building construction. I shall leave such estimates to others, but I am impressed by the fact that an exceptional opportunity is rapidly approaching extension workers in both public and private service to aid farm families in making satisfying investments in housing which they can enjoy with enduring pride.

Serving Agriculture

AS engineers serving agriculture, we have every reason to feel confident that if given the opportunity to utilize the forces and materials of nature for the benefit of mankind, there should be actual freedom from want for the essentials of healthy living for all worthy people of our nation. Likewise, if given the opportunity engineers can assist other technologists in pointing the way toward this goal for all of the peoples of the world. No other technical profession is so closely related to the people it serves as agricultural engineers. Not only do they supply agriculture with those things needed for efficient production, processing, storage, and transportation of the products of the land but they are also concerned with those things which contribute to the welfare and comfort of those who live on the land.

This brings us in close contact with the problems of rural folks. Their way of life is our concern and as engineers we should give some thought to the future pattern for agriculture. It would seem from past experience that the foundation of our food and fiber supply rests upon an intelligent farm people properly equipped with modern power and field equipment used for the most part on independently operated farms where the farmer and his family and his workers may live in comfort with conveniences which engineering functioning through the industrial plants of the nation can supply.

Agriculture is the only industry which through sound scientific and technological practices may restore to the land on which it operates the substances removed through cropping cycles. Thus the soil is a basic resource which need not be permanently expended if properly husbanded. Engineers have a direct responsibility in the conservation of our soils.

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Fire Hazards Relating to Hybrid Seed Corn

By L. G. Keeney
MEMBER A.S.A.E.

THE burning rate of seed corn drying establishments in the Middle West has occasioned much alarm among growers, plant owners and insurance companies. The many thousands of bushels of hybrid seed corn which are processed annually are handled by two general classes of drying plants, namely, (1) commercial plants which cover a territory of one or more states and (2) independent producers with smaller plants serving limited areas. Although the general problems encountered in hybrid seed corn processing are the same for all types of plants, the small plant operators appear to have suffered the greater amount of fire loss. This is probably due to the fact that some of the smaller concerns have lacked proper equipment and knowledge of safety requirements.

The purpose of this paper is to set forth some important physical hazards which have direct bearing on fire safety in drying plants and to mention other considerations which affect the insurance risk.

The artificial drying operation is necessary to reduce the moisture content of the seed corn in order to avoid spoilage from freezing and mold. It is necessary to complete the drying operation quickly to provide for processing a maximum amount of seed during a period of a few weeks. It is desirable to reduce the moisture content of seed corn to 12 or 13 per cent, and the time which is required will of course depend upon the original moisture content, the atmospheric conditions at the time of the drying period, the velocity of the air through the corn and the temperature of the drying aid. The air should be circulated as rapidly as possible and at a temperature not to exceed 110 F (degrees Fahrenheit).

Drying Equipment. In addition to the drying bins, air ducts and vents, the required drying equipment consists of a heating unit and blower. The heating unit, usually fired by coal or oil, is either installed in the drying building as fixed equipment, or is mounted on wheels or skids so that it may be moved from one building to another. The most common equipment is a combination oil-fired heater and blower installed in a metal-covered, portable unit. The warm air vent on the drier is attached to the duct leading to the drying bins by means of sheet metal or canvas. In other cases, an oil burner or stoker are installed as fixed equipment, with permanent attachment being made to the drying duct.

Thermostatic control of both the burner and the blower is the first requirement for corn drying equipment. At least one thermostat should be installed where the warm air passes to the drying duct, and this instrument should be set at a point not to exceed 110 F. We have found several driers which had no thermostatic control, the explanation being that the burner was not capable of producing heat in excess of 110 F. It is conceivable that this might be true if we are to assume that the blower will continue to operate at all times while the burner is running. A homemade drier was responsible for a $30,000 fire which we investigated a short time ago. The oil burner operated on one electrical circuit and the motor which powered the blower on another. There was no synchronized control of the two units, and there was nothing to prevent the temperature from going completely out of bounds if the blower motor or the electrical service supplying it failed. It is best for the blower to be controlled by a separate thermostat so that it will run as long as the temperature of the air in the heating chamber is within certain limits. The burner should be controlled by at least one thermostat, preferably two, so that it will cease to operate if the temperature exceeds 110 F.

The second requirement for safety is to screen the burner so that it is impossible for husks, corn silk or other foreign material to pass by the heating chamber into the ducts and drying bins. We have found many screenless portable driers in connection with farm plants, at least one of which caused a disastrous fire. The screens may be placed around the base of a portable drier, or they may be installed at the point where the warm air passes through the duct.

Fuel Storage. Fuel storage presents another problem around drying plants. The oil-burning plants usually have several hundred gallons of fuel oil in tanks situated close to or within drying buildings. Many of the tanks are set on wooden platforms above ground and some are merely open barrels. In case of fire from any cause, fuel stored in such a manner would present a serious problem.

Lightning Protection and Grounding. There are other fire hazards about drying plants which deserve attention. Many of the larger drying and storage buildings do not have adequate protection from lightning. In addition to conventional lightning protection systems, metallic elevator equipment, metal bins, oil storage tanks and other metal parts should be inter-connected and grounded according to the circumstances. Grounding of metal shafts and other metal equipment will also reduce the danger from dust explosions which are a real danger where grain is processed.

Heating Equipment. Although requirements for ordinary heating equipment are usually not great around drying plants, there is some occasion to heat work rooms and office spaces built in connection with the major building units. We have been surprised to find all sorts of stove and chimney arrangements used for heating offices. Tin pipes extending through combustible roofs are common, as are smoke pipes which pass through frame walls. In one case, the smoke pipe joined a tile chimney which was built outside of a frame wall. The pipe passed directly through the wooden wall, which had ignited several times during the period of two or three years. The owner would not have tolerated such an arrangement in his dwelling, but he appeared not to worry much about it in connection with the drying plant. A sound rule is to require brick chimneys and well-installed heating equipment in every case.

Transient Workers. A seasonal hazard is introduced in many plants due to the fact that transient workers are imported during the detasseling period. The buildings around the drying plants are frequently used for dormitories, and temporary cooking equipment is sometimes installed. The hazards connected with housing transient workers are obvious.

Dangers from Seed Spoilage. This paper has dealt thus far with fire hazards in connection with the physical plant, but we cannot overlook the problem which is presented when seed corn becomes unmarketable because of reduced germination. There is a serious temptation to "sell" a stock of corn to the insurance company at seed prices if it must otherwise be placed on the market at the price of ordinary corn.

Corn may be rendered worthless for seed in several different ways. A drying temperature in excess of 110 F is not desirable and we are told that a temperature of 125 F for even a short period of time is ruinous. Another condition arises if freezing temperatures prevail before the drying operation is completed. A third possibility is loss of germination due to excessive moisture resulting in molding and spoilage before and during the period of dehydration. With these possibilities in mind, it is apparent that the *(Continued on page 76)*

This picture shows what remains of a homemade portable seed corn drier. The oil burner and blower in the drying unit were electrically controlled but were wired in such a way that the burner could continue to operate even though the blower was out of commission. This makeshift was responsible for the loss of three buildings and hybrid seed corn valued at $30,000

A paper presented before the National Association of Mutual Insurance Companies at Chicago, November, 1944.

L. G. KEENEY, a graduate agricultural engineer, is secretary of the Farmers Mutual Reinsurance Association.

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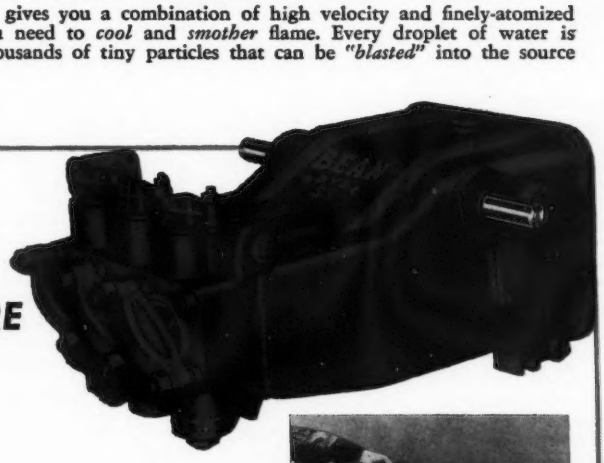

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As the flames rolled up, the *local* firemen moved in with two FMC Fog Fire Fighter Guns. And—*the big House Fire of the Series was knocked down in one minute, with less than 70 gallons of water.* There was no water in the cellar after the last of the 4 fires was out.

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Fire Hazards Relating to Hybrid Seed Corn

(Continued from page 74)

dangers involved in writing hybrid seed corn insurance are greater than the mere physical hazards which are fairly well defined.

CONCLUSION

The rapid growth and development of the hybrid seed corn industry has brought about conditions which are perplexing. Many drying plants have not been built according to a preconceived plan but have simply been added to as fast as extra facilities were needed. An excessive number of fires indicates the use of faulty drying equipment and buildings of inferior construction.

Careful attention must be paid to the installation of drying equipment and to the thermostatic control of stokers, oil burners and other heating units. Controls of forced-air circulation systems must be coordinated with those of the drying equipment to assure safe operation. The addition of an extra thermostat will assure safety should one instrument fail to function. Protection against lightning, control of the hazards of fuel storage and dust explosions, as well as care in the installation of heating equipment are necessary to assure reasonable safety. And, finally, insurance companies and rating bureaus should take into account the danger which arises if the germinative properties of the seed are reduced for any reason.

A Survey of Hay Handling Methods

By C. B. Richey
MEMBER A.S.A.E.

ONE of the objectives of the Committee on Hay Handling and Storage of the American Society of Agricultural Engineers is to record changes in hay crop production and methods of handling. The accompanying table gives the results of a second survey of trends in hay handling methods sponsored by the Committee, the first having been made in June, 1942, and published in AGRICULTURAL ENGINEERING for November, 1942.

Most of the persons contributing the information for the survey are extension agricultural engineers. They would be the last to claim that their reports are statistically correct; however, they comprise an impartial group of men who are in contact with large numbers of progressive farmers in the various states, and it is believed their estimates of the situation provide a very good indication of current trends.

A comparison of this survey with the one made in 1942 indicates that the power buck rake and the pickup baler gained in use most rapidly since that time.

The Results of a Survey of Trends in Hay Handling Methods from Windrow to Storage
Survey Completed, September, 1944

A CONTRIBUTION OF THE COMMITTEE ON HAY HARVESTING AND STORAGE OF THE AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS, PREPARED BY C. B. RICHEY, CHAIRMAN

State	1942-43 ave. hay production in per cent of U.S. total	Approx. hay acreage per farm	Major methods ranked as to present importance	Major methods ranked as to rate of increase	Reported by
Maine	.86	23	ahlr bhlr dilr ehlr bhot	dilr eh(l,p)r	M. G. Huber, Maine
New Hampshire	.42	35	bhlr ahlr di(l,c)r eh(l,p)r	di(l,o)r eh(l,p)r	F. M. Foulkrod, New Hampshire
Vermont	1.16	35	bhlr ehlr dilr ahlr	ehlr dilr	Herman Atkins, North Hero, Vt.
Connecticut	.43	40	bhlr ahnr bhot ehlr dilr diot uhw(r,t)	ehlr dilr bhlr uhw(r,t)	G. W. Crowther, Connecticut
New York	5.97	30	bhlr dilr eh(l,p)r ahlr dio(r,t) uhw(r,t)	dilr ehpr uhwr	C. N. Turner, Cornell University
New Jersey	.39	20-30	bhlr ehpr uhwr dilr		W. C. Krueger, Rutgers University
Pennsylvania	3.29	20-40	bhlr dilr eh(l,p)r ahnr	eh(l,p)r dilr	R. J. McCall, Penn. State College
Ohio	3.50	25-30	bhlr dilr eh(l,n)r	dilr ehlr	R. D. Barden, Ohio State University
Indiana	2.75	35-40	bh(l,w)r dilr eh(l,p)r uhwr	uhwr ehpr	R. C. Shipman, Purdue University
Illinois	3.61	25	bhlr ahlr ehpr dilr dfhlr uhwr	ehpr dilr uhwr	R. I. Shawl, Illinois
Michigan	3.80		bhlr ahlr ehnr dilr	ehnr dilr	E. G. McKibben, Michigan
Wisconsin	7.23	22	bhlr ehlr di(l,o)r uhw(r,t)	ehlr di(l,o)r uhwr	F. W. Duffee, Wisconsin
Minnesota	6.72	30-40	bhlr cms ehlr ah(s,r)	ehlr dilr gqs	A. J. Schwantes et al, Minnesota
Iowa	5.82	17½	bhlr ahlr dil(r,s) eh(l,p)r gqs,uhw(r,t)	uhwr dilr gqs eh(l,p)r uhwt	J. B. Davidson, Iowa
Missouri	4.06	18.2	ahl(r,s) (c,d)is cfhnr ehnr	ehpr dilr d(m,g)s	Jas. E. Crosby, Jr., Missouri
Nebraska	3.91	50	di(m,q)s cjms bhlr cfhlr eh(l,p)(r,s)	dms gqs bhl(r,s)	W. J. Promersberger, North Dakota
North Dakota	3.10	45	dms cms bhl(r,s) ahl(r,s) gqs	ehp(r,s) gqs diqs uhwt	L. F. Larsen, Nebraska
Kansas	2.51		(c,d)ms bhlr dfhn(r,s) ehn(r,s) gqs		John Ferguson, Kansas
Maryland	.54	25-30	bhlr eh(n,p)r ahlr dilr	eh(n,p)r dilr	A. O. Kuhn & R. W. Carpenter, Md.
Virginia	1.43	25	ahlr bhlr ahns eh(n,l)(r,s) (a,b)hot cns dilr	bhlr ehlr	E. T. Swink, Virginia
West Virginia	.93	11.6	ahns bhlr cns dilr		R. J. Friant, W. Virginia
North Carolina	1.20	5	ahns ahnr bhlr cns	bhlr cfhnr	D. S. Weaver, North Carolina
South Carolina	.50	10	ahns cfhnr bhlr cns ehnr	ehnr bhot	C. V. Phagan, Clemson Agr. College
Georgia	.88	5	ahns ahlr	ahlr cns	Harold D. White, Georgia
Kentucky	2.16		ahnr ehnr bhlr	ehnr	J. B. Kelley, Kentucky
Tennessee	2.26	10	ahnr bhlr ehlr cns	ehlr	M. T. Gowder, Tennessee
Alabama	.84		ahfn(r,s) cfns bhlr ehnr		J. B. Wilson, Alabama
Mississippi	1.04	6-8	ahns ehnr uhwt	ehnr uhwt	J. T. Copeland, Mississippi
Arkansas	1.36	15	fhnr ahns ahnr ahlr bhlr ehnr cns	ehnr	Earl K. Rambo, Arkansas
Oklahoma	1.78		cns ehnr	ehnr	Leslie L. Hazen, Oklahoma
Texas	1.61	12 a. on farms having hay	cfhnr ahns cms ehn(r,s)	ehn(r,s) cfhn(r,s) dms	M. R. Bentley, Texas
Montana	2.57	60-80	dms cms ehps	dms ehps	O. W. Monson, Montana
Wyoming	1.11	50-250	cms dms gqs bhlr ehl(r,s)	gqs dms ehl(r,s)	Geo. W. Boyd, Wyoming
Colorado	2.18		dms cms cfns ehns	ehns	Alvin Kezer, Colorado
Oregon	1.83	20-200	dms ehlr cms cfhlr akhr bhlr	dms ehlr uhwt	Clyde Walker, Oregon
California	5.25		ehns dfns gqs ahlr ahor uhwr		Roy Bainer, California
36 states	89.00				

Total production of U. S. (1942-43 ave.) 102,418,000

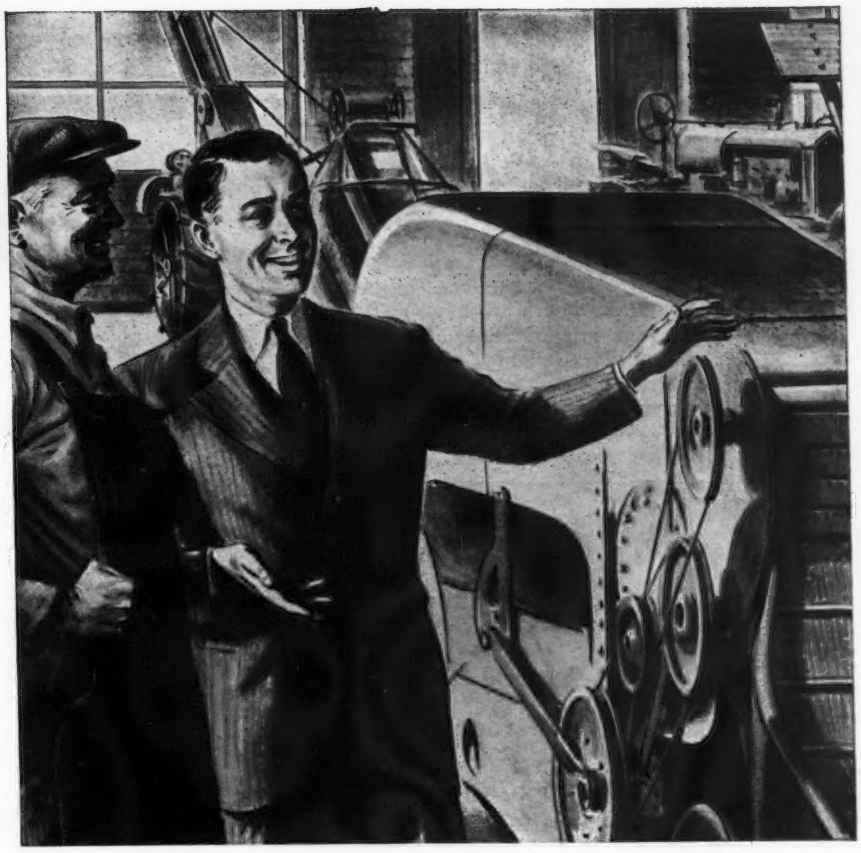
KEY TO TABLE: *Collecting* — (a) Pitch fork, (b) hay loader, (c) horse buck rake, (d) power buck rake, (e) pickup baler, (f) stationary baler, (g) combination buck stacker, (u) field chopper.

Transporting — (h) wagon or truck, (i) power buck rake, (j) horse buck rake, (k) slip.

Storing — (l) hay fork or slings, (m) stacker, (n) hand, (o) stationary chopper, (p) elevator, (q) combination buck stacker, (w) blower.

Storage — (r) barn, (s) stack, (t) silo

• The "Scratch Test" shows how paint sticks to ARMCO Galvanized PAINTGRIP. The top half of the sample is Bonderized. When scratched with a penknife only a superficial mark is noticeable. Paint on ordinary galvanized (bottom half) peels off readily.



The new machines are "armored" against rust

Many of the new combines and corn-pickers that will be on the market this year will have sheet metal parts made of ARMCO ZINCGRIP-PAINTGRIP and ARMCO Galvanized PAINTGRIP steel.

The war years have amply demonstrated to farmers that these Armco *special purpose* sheet steels provide insurance against failure due to rusting. Leading manufacturers are using these sheets to give their valuable machinery 3-way protection against rust.

1. These special-quality steel sheets have a *full-weight coating of zinc.* 2. This protective coating is then Bonderized at the mill to take and hold an attractive paint finish. 3. Exposure tests in various climates show that *paint* lasts several times longer on ARMCO PAINTGRIP-treated steel.

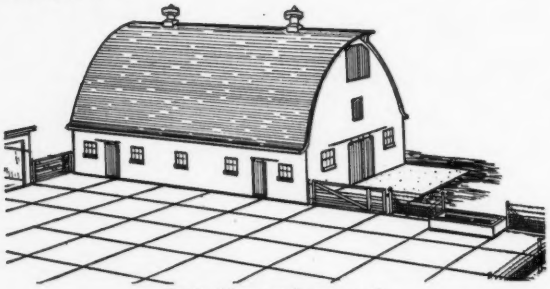
You will be doing your farmer friends a good turn by telling them about the rust protection offered by PAINTGRIP sheets. If you are helping manufacturers design new farm machinery, metal buildings or equipment, then PAINTGRIP steel certainly belongs in your plans. Products will last longer, look better and require less upkeep when they are made of PAINTGRIP or ZINCGRIP-PAINTGRIP. For further information on these Armco *special purpose* sheet steels, write to The American Rolling Mill Company, 431 Curtis St., Middletown, Ohio.

MADE OF ARMCO GALVANIZED PAINTGRIP

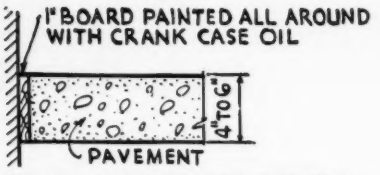
SPECIAL PURPOSE SHEET STEELS FOR TOMORROW'S FARMING

An *Engineered* Barnyard Pavement

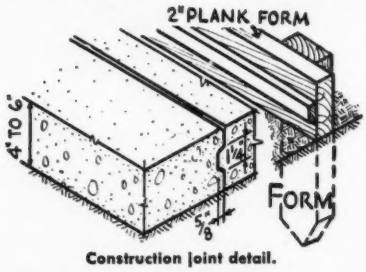
There is more to building a barnyard pavement than merely placing a slab of concrete. The engineered design features shown below are a few of the details we have available to agricultural engineers. These will assist in giving the farmer added years of profitable service from farm improvements built to aid the war food problem.



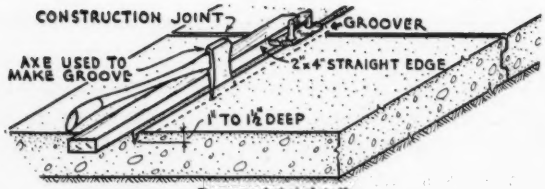
Typical barnyard pavement.



Expansion joints between slab and building.



Construction joint detail.



Dummy joint detail.

PORTLAND CEMENT ASSOCIATION

Dept. A2-1, 33 W. Grand Ave., Chicago 10, Ill.

A national organization to improve and extend the uses of concrete . . . through scientific research and engineering field work

NEWS SECTION

A.S.A.E. Meetings Calendar

February 19 and 20 — SOUTHEAST SECTION, Piedmont Hotel, Atlanta, Ga.

June 25, 26 and 27 — ANNUAL MEETING, Hotel Schroeder, Milwaukee, Wis. (Will probably be cancelled)

December 18, 19 and 20—FALL MEETING, Stevens Hotel, Chicago

Pacific Coast Section Elects J. W. Gross

AT ITS 23rd annual business meeting held at Davis, California, January 17, the Pacific Coast Section of the American Society of Agricultural Engineers elected Joseph W. Gross, a civil engineer of Sacramento, as the new Section chairman. T. A. Bither, chief field engineer of the California Corrugated Culvert Company, was elected first vice-chairman; H. C. Schwalen, professor of agricultural engineering, University of Arizona, was elected second vice-chairman, and K. R. Frost, assistant professor of agricultural engineering, University of Idaho, was elected third vice-chairman. Jim Lyon, manager of the Lyon Rural Electric Company, was elected a member of the Executive Committee, and Walter W. Weir, drainage engineer, division of soils, University of California, was re-elected secretary-treasurer. The Nominating Committee for the coming year consists of C. N. Johnston (chairman), F. E. Price, and Osgood Murdock.

About forty members and friends of the Section attended the meeting at Davis.

George Kable Honored

A HAPPY and appropriate interlude in the program of the 16th annual farm electrification conference at Purdue University, January 8 and 9, occurred when George W. Kable, editor of "Electricity on the Farm" and president of the American Society of Agricultural Engineers, 1941-42, was presented with a citation of distinction awarded him by Epsilon Sigma Phi for his outstanding contribution to agricultural engineering.

Epsilon Sigma Phi is an honorary fraternity for agricultural extension workers, and at its meeting in Chicago last October it awarded Mr. Kable a certificate of recognition at large for his work as a former county agricultural agent, as a 4-H club leader, and as a rural electrification specialist for the Committee on the Relation of Electricity to Agriculture and the Tennessee Valley Authority.

It so happened that Mr. Kable was the speaker at the farm electrification banquet at the Purdue conference, and the occasion was selected for formal presentation of the certificate, which was made by L. E. Hoffman, a local member of Epsilon Sigma Phi and associate director of agricultural extension at Purdue University.

(News continued on page 80)

Geo. W. Kable (right), past-president of A.S.A.E., receiving citation of distinction in agricultural engineering from L. E. Hoffman

This University of Nebraska Test is Convincing to Farmers

FROM THE UNIVERSITY of NEBRASKA 4-H TRACTOR CLUB MANUAL:—

Club members are urged to try the following experiments on different lubricants and observe the results.

1. Shock load. A hammer, flat piece of iron, and a number of different types of greases are needed for this experiment. It is desirable to have a chassis lubricant of the "tacky or stringy type" and a cup grease in the assortment of greases. Place a sample of grease, about the size of a cherry, on the iron and then hit the grease with a hammer. You will notice how some greases splatter more than others. This will give an indication of the superior ability of the "tacky" type grease to absorb a shock load, as is present in a mower pitman bearing.

FARMERS WHO SAW IT SAID THEY WOULD NEVER USE CUP GREASE AGAIN FOR FARM MACHINERY LUBRICATION!

MARFAK ABSORBED THE BLOW, without spattering, was ready for another rap.

CUP GREASE SPATTERED all around, leaving practically a bare spot under the hammer.

IT is well known that thousands of farmers use ordinary cup grease as an all-purpose lubricant, in fact for anything that needs "greasing."

The novel University of Nebraska "Hammer Test" described above, knocks this practice out of a farmer's mind, according to the reports of the Agricultural Engineers who used it at Farm Meetings in Nebraska last winter.

If it works so well in Nebraska, it may work elsewhere with equally good results.

Texaco's well known lubricant Marfak and some cup grease were put through the Nebraska test. The results are illustrated above.

The superiority of Marfak lubricant has been proved in farm machinery operation under extreme conditions of temperature. It is highly resistant to water wash and oxidation. It clings to bearings, will not jar off or drip out.

Marfak is one of Texaco's Products for the farm that will enable the farmer to get more out of his machinery.

THE TEXAS COMPANY

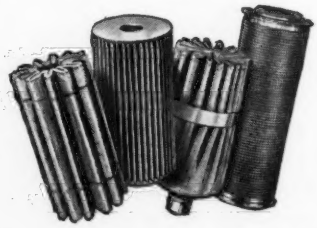
TEXACO

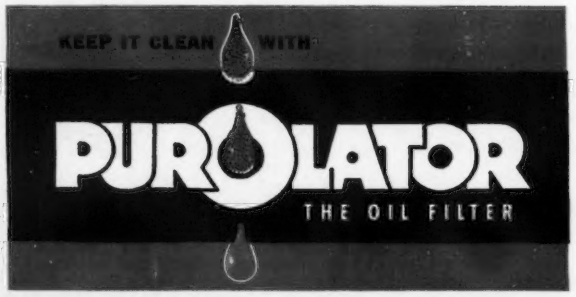
KEEP YOUR WAR EQUIPMENT FOOD FIGHTS FIT AND FIGHTING

WIN THE WAR ON WEAR WITH TEXACO PRODUCTS FOR THE FARM

DISTRICT OFFICES: Atlanta 1, Ga.; Boston 17, Mass.; Buffalo 3, N.Y.; Butte, Mont.; Chicago 4, Ill.; Dallas 2, Tex.; Denver 1, Colo.; Houston 1, Tex.; Indianapolis 1, Ind.; Los Angeles 15, Calif.; Minneapolis 2, Minn.; New Orleans 6, La.; New York 17, N.Y.; Norfolk 1, Va.; Seattle 11, Wash.
Texaco Products also distributed by McColl-Frontenac Oil Company, Limited, Montreal, Canada

PUROLATOR makes all types of tractor oil filters and tractor oil filter elements, *engineered* to fit the specifications of tractor and engine manufacturers. In fact, Purolator makes and sells more tractor oil filters and tractor oil filter elements than all the rest of the oil filter industry combined. Purolator, founder and leader of the oil filter industry, will gladly assist you in problems of filtration, especially those relating to scientific farming. Purolator Products, Inc., Newark 5, New Jersey.





FOOD FIGHTS FOR FREEDOM!

Farrall Heads Chicago Section

ARTHUR W. Farrall, director of research, Creamery Package Mfg. Co., was elected chairman of the Chicago Section of the American Society of Agricultural Engineers at a meeting of the Section held February 5th. Two new vice-chairmen were also elected—E. L. Hansen, agricultural engineer, Portland Cement Assn., and W. A. Pohlman, president, National Electric Screen Corp. Hugh C. Smith, manager, agricultural department, The Sisalkraft Co., is the new secretary-treasurer of the Section.

A group of between thirty and forty A.S.A.E. members and friends attended the meeting, the feature of which was an inspiring and thought-provoking talk by Dr. George D. Scarseth, formerly head of the department of agronomy at Purdue University and now director of research of the American Farm Research Assn. Dr. Scarseth's talk dealt with putting into practical use *now* the findings of research already available. It was a talk this scribe would like to see repeated on a general program at one of the Society's national meetings.

The Section was specially honored in having the A.S.A.E. president-nominate, J. Dewey Long, chief of the research department of the Douglas Fir Plywood Association, in attendance at its meeting.

British Ag Engineers Active

THE Institution of British Agricultural Engineers, with headquarters at 58 Gordon Square, W.C.1, London, even under the difficult conditions incident to wartime, has continued to function and make progress, according to word received from the organization's secretary, C. Horton.

In the autumn of 1943 a series of four open meetings were planned. These meetings were held in November, 1943, and in January, February, and March, 1944.

The program feature of the first meeting was a paper, entitled "Mechanization in Farming," by S. S. McKay of the Sunshine Harvester Co. "The Mechanization of the Family Farm," by Professor D. B. Johnstone-Wallace, deputy director, National Institute of Agricultural Engineering, was the subject of the paper presented at the second meeting. Clyde Higgs presented the feature paper, entitled "The Mechanization of the Mixed Farm," at the Institution's third meeting, and a paper, entitled "Mechanization in Market Gardening" by F. A. Secrett, was the principal topic at the fourth meeting.

These four papers together with accompanying discussions have been republished in four separate proceedings of the Institution (Vol. III — February, May, August, and November, 1944). In the proceedings of the second meeting is also included a memorandum, entitled "The Training of the Agricultural Engineer," prepared by the Council of the I.B.A.E.

The Institution is now holding a similar series of meetings, the papers and discussions of which will be published in their proceedings for 1945. The first meeting of the present series, held last October, featured a paper, entitled "Harvesting Machinery," by Cornelius Davies of the South Eastern Agricultural College. At the November meeting a paper, entitled "Machinery for Crop Cultivation" was presented by C. Culpin, agricultural organiser for Worcestershire. The program of the January meeting featured the subject "Soil Cultivation." A paper supporting intensive cultivation was presented by T. A. Wedderspoon, chairman of the Angus Agricultural Committee, and another paper supporting the minimum of cultivation was presented by E. W. Russell of the Rothamsted Experimental Station. The February meeting, to be held later this month, will have the subject "Internal Farm Mechanization" as the major topic of discussion, the principal paper on which will be presented by C. A. Cameron Brown of the British Electrical and Allied Industries Research Association.

Personals of A.S.A.E. Members

Walter T. Ackerman, until recently district engineer (Region 1) of the Farm Security Administration, has severed his connection with that government agency to accept the position of farm service director of the Connecticut Light and Power Co., at Waterbury, Conn.

Seigel A. Anderson, formerly a member of the agricultural engineering staff at Purdue University, specializing in rural electrification, and for the past year and a half serving as general manager of the Indiana Statewide R. E. Co-operative, Inc., recently became a partner in the R. V. Polski Mfg. Co., St. Paul, Minn., manufacturers of wood and textile products.

Lindley G. Cook, extension soil conservationist, this month becomes associate director of the New Jersey Extension Service. He will supervise the work of the Service under the general direction of Dr. W. H. Martin who will assume the duties of extension director in addition to those of dean of agriculture and director of the experiment station. Since 1935 when *(Continued on page 82)*

BASICALLY SOUND IN DESIGN...

13-ton Euclid Dump Truck Lipe-Clutch Equipped

Weighing 30 tons and carrying a 105 m.m. gun, this Lipe-equipped tank destroyer rolls off a landing barge to smash German Mark IV's and concrete pillboxes "somewhere in Europe." (Signal Corps Photo.)

That's why

LIPE HEAVY-DUTY CLUTCHES

give top performance under severe conditions

A Lipe 13" single-plate clutch is used in the Diesel-powered Buckeye Ditcher shown here at work on the "Big Inch" pipeline. Similar machines have dug pipe lines in Sumatra, Iraq and Roumania.

Of course, Lipe Heavy-Duty Clutches are in the tanks and tank destroyers that storm the invasion beaches. They're in the prime movers, the transport vehicles, the wreckers and the mammoth tank retrievers. And they've handled the torque on giant Diesel-powered ditchers that blazed the trail for the "Big Inch" pipeline from Texas to Pennsylvania.

But why Lipe clutches for all this, you ask? The answer is easy. *Lipe basic design is sound;* it stands up where the going is toughest. That's because Lipe engineering, "know how" and manufacturing standards have all been sharpened on the toughest automotive problems in America — that of heavy-duty trucks, road graders and earth movers. Eighty-five percent of America's heavy truck makers use Lipe clutches.

That sort of recognition and acceptance is not won easily. Doesn't it give you an idea that Lipe engineers could solve your clutch problems? Give them a chance and see. Tell us your problems in writing or drawing, or ask for a technical representative to call. No obligation.

LIPE-ROLLWAY CORPORATION • SYRACUSE 1, N. Y.

Personals of A.S.A.E. Members

(Continued from page 80)

he joined the U. S. Soil Conservation Service as a conservationist working in the northern part of New Jersey, Mr. Cook has been closely associated with the development of soil conservation districts. In 1940 he became cooperative agent employed jointly by the New Jersey Extension Service and the Soil Conservation Service.

Ellis G. Diseker is now engaged as agricultural engineer (Region 2), Soil Conservation Service, U. S. Department of Agriculture. He is located at Auburn, Alabama, and is engaged in research in drainage and farm machinery.

Alfred D. Edgar, agricultural engineer (B.P.I.S.A.E.), U. S. Department of Agriculture, and *Thomas E. Long,* assistant agricultural engineer, North Dakota Agricultural Experiment Station, are joint authors of two publications, entitled "Potato Storage for the Red River Valley" and "Insulation for Red River Valley Potato Storage," issued recently as Circulars 70 and 71, respectively, by the North Dakota Agricultural Experiment Station.

K. R. Frost, assistant professor of agricultural engineering at the University of Idaho, is author of "Treatment for Domestic, Farm, and Industrial Water Supplies" issued recently as Circular No. 90 or the Idaho Agricultural Experiment Station.

Elmer W. Gain who has been serving as associate drainage engineer, Office of Foreign Agricultural Relations, U. S. Department of Agriculture, has recently returned from foreign service, and has been reassigned to the Soil Conservation Service, with headquarters at Wapakoneta, Ohio.

R. B. Hickok, research project supervisor (agricultural hydrologic studies) for the U. S. Soil Conservation Service at Purdue Agricultural Experiment Station, is one of the authors of a mimeographed bulletin (No. 61), entitled "Improved Practices Reduce Loss of Available Nutrients by Run-Off," issued recently by the department of agronomy at Purdue.

D. A. Isler, more recently serving as farm machinery superintendent of War Hemp Industries, Inc., has now returned to the USDA Bureau of Plant Industry, Soils and Agricultural Engineering. He will engage in development of methods and equipment for the application of insecticide by airplane, and will be located at Toledo, Ohio.

C. H. Jefferson, assistant professor of agricultural engineering, Michigan State College, was appointed recently to the newly formed township building code advisory committee of the Michigan Planning Commission. The function of the committee is to draft a a model building code for Michigan rural areas.

Joseph Mader, who has been tractor and implement engineer for the S. L. Allen and Company for the past twenty-three years, recently joined the Maremont Automotive Products, Inc., of Chicago, as chief engineer of the farm tool division.

Clark Prudhon, until recently connected with the American Rolling Mill Company in an engineering capacity, is now agricultural engineer for the Evans Products Company, and is located at Lafayette, Indiana, where he will engage in studying farm building design in connection with his company's interest in the farm building materials market.

Ralph L. Ricketts, extension agricultural engineer, and *J. C. Wooley,* head, agricultural engineering department, University of Missouri, are authors of "The Curved Roof Machinery Building", recently issued as Circular 296 by that institution.

L. J. Smith and *O. J. Trenary,* agricultural engineers, Washington Agricultural Experiment Station, are authors of "The Jeep as a Farm Truck-Tractor for the Postwar Period" recently published as Bulletin No. 445 of that station.

George E. Webster, until recently instructor in agricultural engineering, University of Vermont, is now principal of the Vermont State School of Agriculture, Randolph Center, Vermont.

Postwar Rural Electrification

A mimeographed report, entitled "Iowa REA Postwar Development Possibilities," has just been issued by the Iowa Rural Electric Cooperative Associations and was prepared by Harold H. Beaty, chairman of the state committee of these associations. Copies may be obtained by writing Mr. Beaty, agricultural engineering department, Iowa State College, Ames.

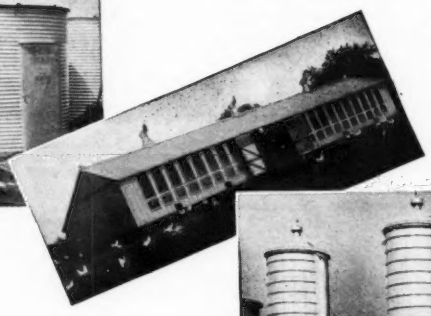
Round and Round They Go,
All Over the World!
EWC WHEELS
We've been making good wheels for more than half a century—and had begun to get a little complacent about it—until people began telling us what a job EWC Wheels were doing all over the world. Our accumulated experience, and modern engineering combine to produce outstandingly fine wheels to meet every need. Now, with the most modern equipment to produce disc wheels, we are in a doubly fine position to work with you.
Write for special information about EWC Wheels.
EWC WHEELS
Electric Wheel Co., Dept. AE Quincy, Ill.

ZINC!

—FOR RUST PREVENTION

on Buildings

Hundreds of thousands of farm and industrial buildings have roofs and sides of galvanized, or Zinc-coated, sheets. Thus not only are the buildings themselves strongly protected against weather, decay and vermin, but the livestock, the crops and the machinery kept within them are safely sheltered.



on Equipment

Galvanized, or Zinc-coated, sheets are widely used also in the manufacture of many kinds of farm equipment, such as combines, separators, seeders, manure spreaders; and numerous parts of these important machines, as well as of many other items of farm and household equipment, are protected against rust by zinc coatings.

U. S. BUREAU
of STANDARDS,
Cir. No. 80, Says:
"Of the metallic coatings, by far the best for general rustproofing is zinc . . . Zinc has the advantage of being electronegative to iron and so prevents its corrosion."

How Zinc Gives Double Protection

Sheets or other metal formations may be coated with zinc in various ways, as by galvanizing, electroplating, or even by painting with metallic zinc paint which has a pigment of metallic zinc dust. Whatever way is used, the zinc provides double protection:

First, by simple coverage, with a sheath of rust-resistant metal.

Second, by electro-chemical action, or "sacrificial corrosion".

Because of this very important, double-protective quality, the U. S. Bureau of Standards has definitely approved zinc as providing "by far the best" metallic coating for the rustproofing of iron or steel.

Full details on the care and maintenance of galvanized products are found in our booklets "How To Make Galvanized Roofing Last Longer" and "Metallic Zinc Paint", sent FREE upon request.

AMERICAN ZINC INSTITUTE
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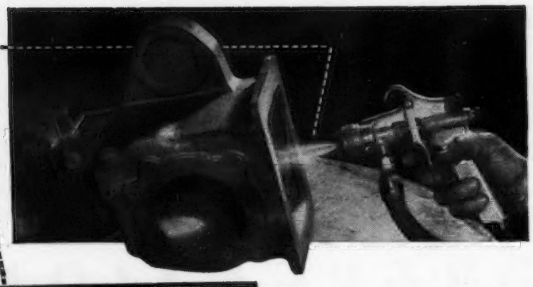
60 East 42nd Street • New York 17, N. Y.



"Interior Decorating"
ISN'T OVERLOOKED, EITHER, IN BUILDING
WISCONSIN
Air-Cooled
ENGINES

The interior of every Wisconsin Engine casting is sprayed with red sealer. This adds nothing to the "beauty" of the engine but it IS an important service and maintenance precaution — because it forever seals any loose particles from entering the oiling system and causing trouble.

Small details such as this are important in safe-guarding the engine user against equipment lay-ups and expense which could otherwise result. You get dependable, heavy-duty serviceability when a Wisconsin Engine is on the job.

Most H.P. per pound
WISCONSIN MOTOR
Corporation
MILWAUKEE 14, WISCONSIN, U. S. A.
World's Largest Builders of Heavy-Duty Air-Cooled Engines

Does Your Equipment Carry a "SEAT-FAG" Operating Handicap?

The simplest part of any piece of heavy-duty mobile equipment, such as tractors, power shovels, road machinery, etc., is usually the seat . . . yet it is often the most neglected part from engineering and end use standpoints. Hard, uncomfortable seats cause SEAT FAG . . . which, in turn, results in reduced efficiency and work-loss!

If your equipment carries a SEAT FAG operating handicap, now is the time to get set with a comfortable seat for your post-war production. MILSCO CUSHION SEATS will fully meet your requirements . . . and Milsco designing engineers are at your service. Let us analyze your seat situation and help you engineer SEAT FAG out of your equipment. Write for copy of Milsco File Folder 44-A.

EQUIPMENT DISTRIBUTORS: Contact us now in regard to unassigned territory.

MILSCO MANUFACTURING CO.
2758-A N. 33rd St. • Milwaukee 10, Wis.

No. 711 JUNIOR SEAT.

No. 783 DELUXE.

No. 833 SENIOR SEAT.

Milsco MILWAUKEE Cushion Seats FOR FARM AND INDUSTRIAL EQUIPMENT

British Agricultural Engineering

ITS annual report for the year ending August 31, 1944, has just been issued by the National Institute of Agricultural Engineering at Askham Bryan, York, England. The general development work of the Institute during the past year comes under the following main headings: Handling of manure, mechanization of potato and root growing, silage-making appliances, grain drying and storage, and the general problem of bringing tractors and their associated equipment more into line with small farm requirements. The report points out that it has become evident that the actual work which the institute can most usefully do will depend on the particular subjects and the way in which commercial development is proceeding. It is in some cases concerned less with the "invention" of new machines than with working out mechanism for particular purposes and with studying underlying principles.

Another essential aspect of the Institute's development work is the collection and collation of general information necessary to give an accurate picture of the practical farm requirements which new machines must meet. A noteworthy feature of the past year has been the number of manufacturers who have found it worth while to consult with the Institute about the type of equipment which farmers need, the general lines which designs should follow, and the innumerable points which distinguish a good implement from a bad one.

Applicants for Membership

The following is a list of recent applicants for membership in the American Society of Agricultural Engineers. Members of the Society are urged to send information relative to applicants for consideration of the Council prior to election.

John R. Albers, chief engineer and secretary, Wincharger Corp., E. 7th & Division Sts., Sioux City 6, Iowa.

Thomas W. Bendixen, assistant soil scientist, Soil Conservation Service, USDA, College Park, Md. (Mail) 4702 Fordham Road.

L. E. Dempsey, vice-president in charge of engineering and production, Dunbar Kapple, Inc., 3609 W. Arthington St., Chicago 24.

Burns Dick, consulting engineer, Wagner Electric Corp. (Mail) 505 Tiffin Ave., Ferguson 21, Mo.

Curtis V. Edwards, chief design engineer, Lindeman Power Equipment Co., P.O. Box 526, Yakima, Wash.

Howard H. Engelbrecht, 1st Lt., AAF, 316th AAFBU, Sq. CX. (Mail) R.R. No. 3, Davenport, Iowa.

J. L. Hipple, engineering supervisor, International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill.

Robert C. Jaska, 1st Lt., Ordnance Section. USA. (Mail) Hq. S.O.S., NSF INCT, APO No. 627, c/o Postmaster, New York City, N. Y.

George E. Johnson, project manager, Skidmore, Owings & Merrill. (Mail) c/o J. B. Pierce Foundation, 40 W. 40th St., New York City, N. Y.

W. H. Kircher, field editor, The Farmer, 55 E. 10th St., St. Paul 2, Minn.

George L. Kurchinsky, chief engineer, Hertzler & Zook Co., Belleville, Pa.

W. S. Lynes, drainage consultant and engineer, Mason City Brick and Tile Co. (Mail) Memorial Union, Ames, Iowa.

Emerson W. Mange, district superintendent, Metropolitan Edison Co. (Mail) 27 Baltimore St., Hanover, Pa.

A. Martin Marburger, engineer, Hertzler & Zook Co., Belleville, Pennsylvania.

Donald P. Markus, assistant to service manager, Harry Ferguson, Inc., Dearborn, Mich.

S. H. McNall, farm structures engineer, Structural Clay Products Institute, 1756 K St., N.W., Washington, D. C.

J. W. Meyer, chief engineer, Lee Wilson & Co., Wilson, Ark. (Mail) 2 Jackson St.

Clarence A. Miller, division rural service supervisor, The Ohio Power Co., 65 E. Main St., Newark, Ohio.

W. J. Moravec, farm production equipment department manager, General Electric Supply Corp., 174 E. 6th St., St. Paul 1, Minn.

Richard E. Morris, drainage engineer, Soil Conservation Service, USDA. (Mail) Box 87, North Liberty, Ind.

D. E. Schwendemann, Lt., EL, USNR, Naval Training School Diesel Engineering, North Carolina State College. (Mail) Duncombe, Iowa.

V. E. Watts, managing director, Vermiculite Research Institute. (Mail) 2540 Eastwood Ave., Evanston, Ill.

TRANSFER OF GRADE

George M. Peterson, associate professor of agricultural engineering, University of Tennessee, Knoxville, Tenn. (Junior Member to Member)

Produce more food ...in '45

THE Farm Machine of Tomorrow —Today, will make it possible to produce more food in '45 with less help. Uncle Sam is calling for increased food production in '45 and it is up to the farmer to meet this demand.

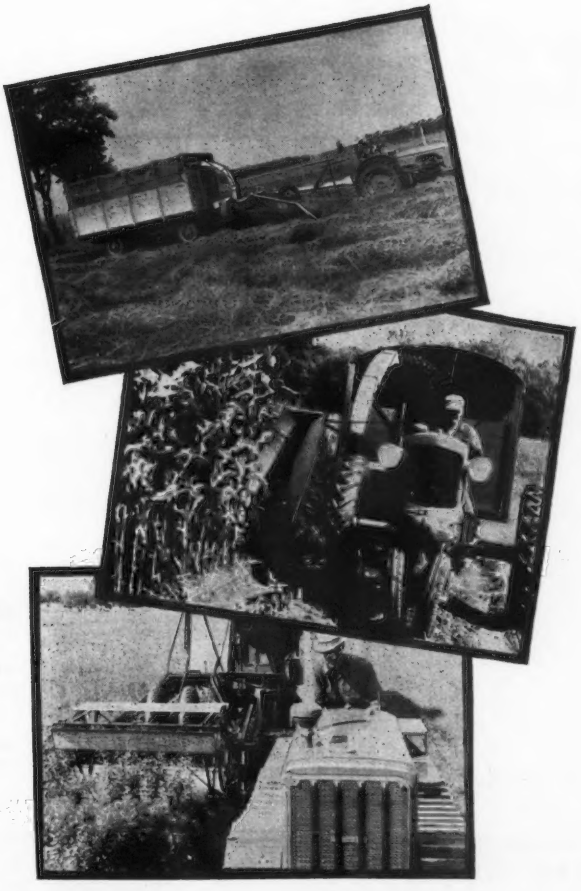
Hay is the answer to our feed problem and feed is the answer to our food problem. Hay is one of the best sources of Protein and the FOX Pick-up Cutter is the best way to make hay.

The FOX solves the manpower problem in Haying and Silage Harvesting. With its Pick-up, Mower Bar and Corn Harvesting units, it is truly the Farm Machine of Tomorrow—Today.

★*The FOX is built by the "Pioneers of Modern Forage Harvesting". WRITE US. We will be glad to tell you all about this marvelous machine.*

R. C. Krueger
Secretary

★ FOX



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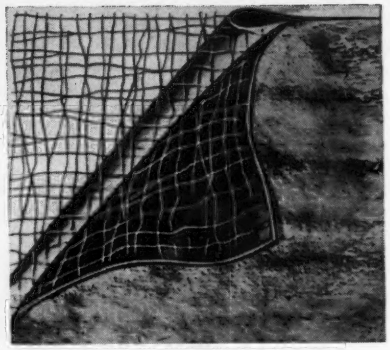

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The two-way fibre reenforcement is embedded in water-proofing adhesive, between two thicknesses of kraft paper, making a durable "blanket" that has been used successfully to protect farm crops and equipment for nearly 25 years.

Folders on Treated SISALKRAFT for Portable Silos, Orange Label SISALKRAFT for Hay Stack Covers, Grain Storage Applications and other farm uses are yours on request.

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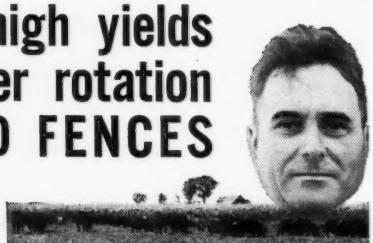
Illinois Corn King

achieves high yields with proper rotation and GOOD FENCES



Clarke Howard, Delavan, winner of the 1943 Illinois 10-Acre Corn Contest with a yield of 136 bushels per acre.

"Eight years ago, we fenced this 320-acre farm into even-sized fields, stocked the farm heavily, and brought legume pasture into the rotation. Last year the entire corn crop averaged 80 bushels per acre; hay 3½ tons per acre. The year before, my 10-acre entry won the Illinois Corn Growing Contest, with no special fertilizer treatment, proving the effectiveness of our soil-building program.

"Our whole farming system depends on **good fences** so we can raise lots of livestock on rotated legume pasture. That's why I believe good fences are the most valuable investment we've made."

New Fence Available—Present Keystone fence . . . though not trade-marked "Red Brand" . . . is tops in quality.

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RATES: Announcements under the heading "Professional Directory" in AGRICULTURAL ENGINEERING will be inserted at the flat rate of $1.00 per line per issue; 50 cents per line to A.S.A.E. members. Minimum charge, four-line basis. Uniform style setup. Copy must be received by first of month of publication.

Buy War Bonds!

EMPLOYMENT BULLETIN

The American Society of Agricultural Engineers conducts an employment service especially for the benefit of its members. Only Society members in good standing may insert notices under "Positions Wanted," or apply for positions under "Positions Open." Both non-members and members seeking to fill positions, for which ASAE members are qualified, are privileged to insert notices under "Positions Open," and to be referred to members listed under "Positions Wanted." Any Notice in this bulletin will be inserted once and will thereafter be discontinued, unless additional insertions are requested. There is no charge for notices published in this bulletin. Requests for insertions should be addressed to ASAE, St. Joseph, Michigan.

POSITIONS OPEN

AGRICULTURAL ENGINEER wanted by the Allahabad Agricultural Institute, Allahabad, India, for teaching position. Minimum qualifications, degree in agricultural engineering and some farm experience. Postgraduate degree desirable. Duties would be primarily teaching, but some opportunity to participate in research and extension. Candidate must be active Christian interested in mission work. Discharged veteran with slight handicap eligible, if in good health otherwise. Applicants may correspond with Mason Vaugh, 1462 Beall Ave., Wooster, Ohio, or Board of Foreign Missions, Presbyterian Church in U.S.A., 156 Fifth Ave., New York 10, N. Y.

DISTRICT MANAGER wanted for western New York. Experience in the sale of dairy farm equipment helpful, but not essential. Must have automobile. Postwar future. Salary, expense allowance, commission, and bonus. Thorough field training, during which salary and expenses are paid. Write in detail, stating age, education, experience, and at least three character references. PO-175

RESEARCH ENGINEER wanted for work in farm structures and rural electrification in a land-grant college in a north central state. A young man is preferred. Salary will depend upon qualifications. Write giving full details of education, experience, draft status, and other particulars. PO-174

FACTORY MANAGER with agricultural engineering background wanted to take charge of a small factory producing barn equipment and hay tools. A permanent position for a man with executive ability and one who is interested in research and development. In first letter give full details as to education, experience, family status, age, etc. PO-173

(Continued on page 88)

DONALDSON CO., INC.

Announces

THE NEW, MOBILE AIR CLEANER

FIELD TEST UNIT

DEVELOPED IN THE INTERESTS OF BETTER DUST PROTECTION

MANUFACTURERS . . .

Now you can make these tests *in the field* easier and with far greater accuracy!

1. Air Cleaner efficiency.
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There must be no lapses of efficiency in air cleaner operation. There must be no unusual conditions under which air cleaners might fail. Dust is roughly equivalent to commercial abrasive in cutting ability, and even a small quantity of this air-borne destruction in fast-moving engine parts, goes a long way in making new engines old.

To make doubly sure of effective, constant protection against dust, to substantiate findings made in its extensive testing laboratories, and to make field testing easier and more accurate, the Donaldson Co. has developed this mobile test unit for its own use and for use by manufacturers.

This unit goes anywhere! For tests, while in motion, it can be drawn behind the tractor in the field. For testing stationary units it can be parked nearby where the unit is in operation. Completely self-contained it is equipped with two internal combustion engines which power individual blowers to provide air flow for testing purposes. As many as four cleaners can be tested simultaneously.

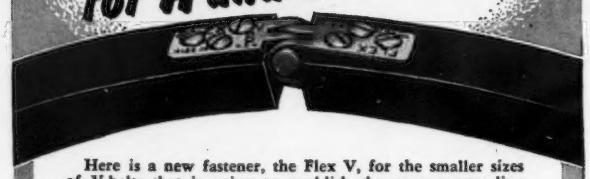
Tests made with the Donaldson Field Test Unit can be accepted as 100% accurate because conditions are precisely those under which the installed cleaner would operate. Manufacturers interested in this kind of conclusive testing are invited to write our Engineering Department for information.

DONALDSON CO., INC. **666 PELHAM BOULEVARD**
SAINT PAUL, MINNESOTA

DONALDSON OIL-WASHED AIR CLEANERS

and now the **FLEX V** TRADE-MARK

A new Fastener for A and B V-belts



Here is a new fastener, the Flex V, for the smaller sizes of V-belts that is going to establish the same outstanding performance record as the Alligator V-belt fastener has already established for the larger sizes of V-belts.

This new Flex V fastener is made in two sizes for A and B section V-belts. It is simple in design, easy to apply and the separable hinge joint makes for quick replacement of V-belts without dismantling shafting or machinery. No metal touches the pulley so Flex V fastened belts can be run on a V-flat drive.

Folder No. V-12 gives complete details on this new Flex V fastener with list prices, special tools and application information. Your request will bring a copy.

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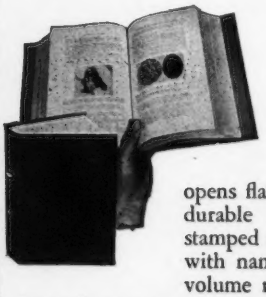

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EMPLOYMENT BULLETIN

(Continued from page 86)

SALES MANAGER wanted. An old-established, expandi company in western New York employing about 150 persons quires the services of a man experienced in the sale of farm m chinery. When applying, give full details as to experience, fam salary, etc. PO-172

MECHANICAL ENGINEER and draftsman required by panding farm machinery plant with postwar future. Please g full details as to education, experience, qualifications, draft s family status and present salary. Include photograph if possib PO-171

ENGINEERS, DRAFTSMEN wanted by a well-known ma facturer of farm and garden implements to develop and design n tools, garden tractors and equipment. Positions permanent. W giving age, salary expected, and full qualifications. PO-168

SALES ENGINEER wanted for permanent position with sm company producing well-accepted building material products. S stantial base salary, better than average proposition for man w liking for sales work and knowledge of building construction. G full information on past experience and earnings expected. PO-1

AGRICULTURAL PRODUCT ENGINEER wanted for m chanical designing and development of corn pickers, combi and other harvesting machines. Permanent position with old w established midwest manufacturer with national distribution. L cated in fine city with adequate housing and educational facili Big postwar farm market assures future. Salary open. Good opp tunity for advancement. Write experience, qualifications, dr status, and other particulars in your letter. PO-165

AGRICULTURAL ENGINEER wanted by a well-known natio al organization to engage in sales promotion work on farm buil ings, preferably someone in his early thirties with good engineeri training and farm background and with plenty of initiative a ingenuity. Special training in farm buildings would be helpful person selected. Discharged service men will receive special co sideration. Write giving full details as to education, experienc etc. PO-164

POSITIONS WANTED

AGRICULTURAL ENGINEER, with B.S. in agricultural en neering from midwestern university, desires position in industry in any branch of agricultural engineering, preferably in soil a water or farm structures fields. Experience in research and develo ment in chemical soil stabilization. Recently honorably discharg from the armed forces. Married and in good physical conditio Age 23. References and professional record available upon reque PW-367

AGRICULTURAL ENGINEER with B.S. degree in agricultu engineering from the A. & M. College of Texas is available f employment. Reared on farm with experience and knowledge operating, repairing and caring for farm machinery. Experienc in farm shop and wood working tools, farm buildings and anim husbandry. Eight years in public school teaching work. Two ye in structural aircraft detail and layout drafting. Age 33. Marrie with two children. Would like position in design and experimen work on farm machinery. PW-366

RESEARCH ENGINEER (electrical-agricultural) is availab Has a bachelor of science degree in electrical engineering (193 master's degree in agriculture (1934), degree of agricultural en neer (1939) and is now working for a Ph. D.; also has engine ing license. Temporarily employed as an extension electrical-ag cultural engineer on wartime food production problems. Ten y one-half years' experience since earning master's degree in agric ture; four and one-half years' in government civil service, and f and one-half years' in other than government service. Born a reared on a farm. Thirty-four years of age, married, two childre Available at a salary range of from $4000 to $8000 per ye PW-365

AGRICULTURAL ENGINEER with a B. S. degree in agric tural engineering from an eastern college is available for empl ment. Experience in soil conservation, drainage, and use of exp sives in land drainage and land clearing; farm reared with experi and knowledge of the operation, care, and adjustment of farm m chinery and equipment, also wood-working equipment and fa building construction. Age 38, married, two children. Would li position in teaching, research, or extension work. PW-362